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GASTROSCOPY.

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"GASTROSCOPY may be defined as the intra-vital inspection of the stomach by a non-operative procedure."⁽¹⁾

As early as 1868 Kussmaul⁽²⁾ introduced a rigid metal tube into the stomach of a professional sword swallower; but he was unable to see the gastric mucosa, as a suitable source of light was then not available.

In 1881, with the advent of electric light, Mikulicz⁽³⁾ designed the first gastroscope to be used for diagnosis. He realized that the teeth and the lower part of the stomach could not be brought into a straight line, so he designed an instrument

which, although rigid, possessed a curve to negotiate the cardia. With this instrument Mikulicz was able to study the action of the pylorus and to diagnose correctly a carcinoma of the stomach. Subsequent gastroscopes were of the straight rigid type, and, although there was a considerable improvement in the optical system of the instruments of Loening-Stieda⁽⁴⁾⁽⁵⁾ and Elsner⁽⁶⁾ (1911), still their application was restricted and their use dangerous. In 1911 Sussmann⁽⁷⁾ constructed a gastroscope which was passed into the stomach as a flexible tube and then straightened after its introduction. Not only was this procedure dangerous, but the system of lenses was frequently dislocated.

Rudolf Schindler⁽⁸⁾ realized that it would be necessary to construct an instrument the lower end of which would be flexible from a point at least three centimetres above the cardia and which could be bent in several planes without distortion of the image. In 1932, after many years of patient work

in collaboration with Georg Wolf, he invented the flexible gastroscope, thereby solving the problems of visibility and safety, which, up till that time, had hindered the progress of gastroscopy. The flexibility of this instrument overcame the danger at the cardia, and by this achievement a fundamental advance in the clinical diagnosis of gastric lesions was made. It is of interest to consider the construction of this instrument. The Wolf-Schindler gastroscope (Figure I) is 75 centimetres long, has the diameter of a stomach tube, and consists of two sections, one rigid and the other flexible. The upper portion, which is the oro-pharyngeal segment of the instrument, is rigid. The upper or oral end carries the eye-piece fitted with a bead which indicates the position of the objective of the optical system, a special arm for the air bellows, and a contact plug



FIGURE I.
The gastroscope.

for the electric wire. It contains a simple optical system. The lower portion is flexible and is made up of a series of short metal cylinders. These cylinders are telescoped into each other and pushed firmly together by a spiral spring which is enclosed in the upper rigid portion. In this manner flexibility and elasticity are obtained. Each metal cylinder contains a system of lenses of very short focal length, so placed that images are transmitted provided that the curve of the instrument does not exceed 34° . The lenses are absolutely enclosed. Two rubber tubes cover and protect this optical and mechanical system. The channel for the introduction of air into the stomach is formed in the flexible portion by a space between these two rubber tubes. The outer tube is perforated in its lower end to permit the entry of air into the stomach. The distal end of the instrument carries a rubber finger attachment, an electric lamp and the objective. A prism inside the objective deviates the axial ray of light 90° .

A prominent feature of the Schindler gastroscope is its optical system. While the cystoscope can be moved in three planes and the bladder wall approached, the gastroscope, on the other hand, requires a long depth of focus, as indicated in Figures VI and VII. In these figures the gastroscope is in position and the stomach is distended with air. The instrument lies to the left of the spine, and by virtue of its long depth of focus the pylorus and the intervening parts of the stomach wall are visible in detail and with clear definition. The sharpness of the picture is remarkable. Through the eye-piece a virtual image is seen, which is upright, right-sided, not deformed and of true colour.

A study of Figures VIII and IX indicates the need for elasticity and flexibility in the gastroscope. In these figures the instrument has been passed through the cardia and is seen lying on the posterior wall of the stomach. It was shown by Kussmaul⁽²⁾ that the mouth, the œsophagus and the cardia could be brought into a straight line, but the posterior wall of the stomach forms an angle with the œsophagus. This is due to the fact that the stomach does not lie in a frontal plane, but slopes from a dorsal to a ventral position between the fundus and lower pole.

Contraindications to Gastroscopy.

The contraindications to gastroscopy with the flexible gastroscope are the same as those which preclude the passage of a stomach tube. Aneurysm of the arch of the aorta, stricture of the œsophagus, obstruction at the cardia, œsophageal varices and severe grades of kyphoscoliosis are obvious contraindications. If a stomach tube passes without difficulty the cardiac orifice of the stomach, the gastroscope can be introduced with safety. However, fluoroscopy may be carried out as a preliminary procedure to exclude the possibility of such lesions.

Technique of Gastroscopy.

Emphasis must be laid on the fact that the introduction of the flexible gastroscope involves little discomfort to the patient. The procedure can be carried out in the consulting room or the out-patient department of a hospital.¹ The examination is made under fasting conditions. Thirty minutes before the examination the patient receives hypodermically 0.01 gramme (one-sixth of a grain) of codein phosphate, together with 0.43 milligramme (one one-hundred-and-fiftieth of a grain) of atropine sulphate. Then the pharynx and hypopharynx are rendered analgesic by painting the posterior pharyngeal wall and spraying the hypopharynx through a perforated rubber tube with a 2% "Pantocain" solution.⁽³⁾ Surface analgesia is effective in fifteen minutes. Now a stomach tube is passed into the stomach and its contents are evacuated by the simple method of lowering the head below the level of the stomach, as shown in Figure II. If the stomach tube is swallowed with ease, the gastroscope can be passed safely. The patient then lies comfortably on his left side on a couch padded with horse-hair, and his head is supported by an assistant who sits in a chair at the top of the table.

The gastroscope is introduced with the patient's head well flexed, and is held like a pen in the right hand (Figure III). The index finger of the left hand lies alongside the tip, thus acting as a guide into the pharynx. The instrument slides over the forefinger into the œsophagus. Its passage through the œsophagus is facilitated by a swallowing movement on the part of the patient. The assistant extends the head, and the tip of the instrument is passed to the lower pole of the stomach. The light

¹ The writer has in the morning examined with the gastroscope in the out-patient department a man who played a strenuous game of League football in the afternoon.

is turned on. Then the stomach is moderately distended with air and its interior becomes visible. By rotating the objective and varying the depth of introduction the various portions of the stomach can be inspected, as shown in Figure IV. The examination lasts from two to five minutes. Then



FIGURE II.
Position for emptying the stomach.

the instrument is slowly withdrawn and the patient is kept under observation for about an hour, until the effects of the local anæsthetic wear off. Then he may go home or return to his work, if necessary, so little does this method of examination cause distress.

The stomach, as the gastroscopist sees it, differs considerably from previous conceptions gained from



FIGURE III.
Introduction of the flexible gastroscope.

operative, anatomical, radiological and physiological studies.

The gastroscope has revealed hitherto unappreciated anatomical facts. The "phantom" stomach devised by Schindler to depict the stomach in the left lateral position is shown in Figure V. Here the gastroscope is in position. It shows that the cardia

is the only fixed point of the stomach. The pylorus is freely movable, and in the left lateral position falls to the left and so occupies a position near the anterior abdominal wall. The lesser curvature does not lie in the axis of the œsophagus. In the first part of its course it moves forward towards the



FIGURE IV.
Inspection of the stomach.

anterior abdominal wall and then continues towards the right side of the body. The model also demonstrates the angle formed by the posterior wall of the stomach with the œsophagus, and emphasizes the need for flexibility and elasticity of the instrument.

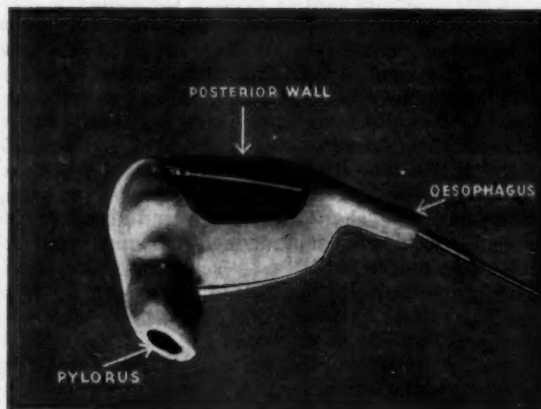


FIGURE V.
Looking down from above on the "phantom" stomach. This figure demonstrates the position of the stomach when the patient lies on his left side. A section of the posterior wall has been removed to show the gastroscope in position. Note the angle formed by the posterior wall of the stomach with the œsophagus. The pylorus falls towards the anterior abdominal wall. The lesser curvature is marked in black.

The development of the relief technique for the study of mucosal folds marked a great advance in radiology of the stomach; but a study of these folds

by means of radiological methods is not in complete harmony with the findings disclosed by the gastro-scope.⁽¹⁾ An X ray examination must always show the projection of two surfaces into one plane, whilst the gastroscopic examination inspects a single surface at a time. The gastroscopist pieces these together to form a composite picture. In the normal stomach the mucous membrane is seen to be orange red in colour, bright and glistening. The orderly arrangement of the mucosal folds can be observed in detail. The rugæ in the fornix and the upper parts of the corpus are wide and tortuous. Gutzeit has likened the mucosal pattern of this part of the stomach to the pattern of the convolutions of the brain. In the remainder of the body the mucosal folds cross and bifurcate. The folds on the anterior wall are narrower and wider apart than those on the posterior wall (see Figure X, A). On both surfaces their direction is roughly parallel to the long axis of the stomach. No mucosal folds are seen with the gastro-scope in the normal pyloric antrum; the lesser curvature is smooth or may show a few shallow longitudinal folds. The lesser curvature of the pyloric antrum is concave towards the cavity of the stomach, and that part immediately beyond the angulus is hidden from view. The *incisura angularis* produces a fold on the lesser curvature which is known as the angulus⁽¹⁴⁾ (see Figure X, C). At this level there is a transverse fold, a formation described and named by Schindler the *musculus sphincter antri*.⁽¹⁰⁾ This rope-like structure circumscribes the gastric cavity and separates the antrum from the body of the stomach (see Figure X, C).

The physiological function of the *musculus sphincter antri* is not definitely known; but Schindler suggests that it divides the stomach into two functionally and anatomically different parts, namely, the corpus and the antrum. A curious feature disclosed by gastroscopic examination is that peristalsis, as a rule, is observed nowhere except in the pyloric antrum. This peristalsis never starts at the *musculus sphincter antri*, but always beyond it.⁽¹¹⁾ The peristaltic waves sweep over the smooth mucosal surface of the pyloric antrum, which is a funnel-shaped structure leading up to the pylorus. Schindler has defined various types of peristaltic movement.⁽¹²⁾ In some cases the peristaltic wave encircles the wall of the pyloric antrum completely and migrates towards the pylorus, which closes and appears to approach the objective. More frequently it commences as an elevated fold near the greater curvature, and, as it passes towards the pylorus, it rises higher and higher on the anterior and posterior walls of the pyloric antrum until it engulfs the pylorus. Sometimes the round open pylorus is seen below and beyond the angulus, and as it approaches the objective converging folds appear in its margin and it becomes stellate in shape. It closes entirely and then reopens as it recedes to its original position. The pylorus may thus open and close without the appearance of peristaltic waves. The pylorus, when open, is circular

and has indentations on its margin. As in the case of other sphincters, when it contracts it takes on the appearance of a rosette-like figure. Just before closure a small quantity of duodenal contents may be seen regurgitating into the stomach.

Gastroscopic Appearances.

The gastroscopic findings in the following conditions are of interest.

Gastric Ulcer.—A benign gastric ulcer can be readily diagnosed with the gastro-scope (see Figure X, D). The floor of the ulcer is of a yellowish or a whitish colour. The edge of the benign ulcer is entirely sharp. The edge may be overhanging or the margin may be crenated; but there is a distinct line of demarcation between the yellowish colour of the base of the ulcer and the orange of the adjacent mucosa. A "red ring" may be seen in the mucous membrane surrounding the ulcer, and its presence may be taken as evidence of healing. In a high percentage of gastric ulcers evidence of gastritis is found in the mucous membrane around the ulcer. The course of an ulcer may be followed by gastroscopy and its healing process observed in response to treatment. Complete healing of an ulcer can be determined with certainty by gastroscopic examination. Frequently the instrument can demonstrate that, although the X ray signs of gastric ulcer have disappeared, the epithelialization of the ulcer is not complete.

Malignant Gastric Ulcer.—A malignant gastric ulcer presents an entirely different picture from the benign (see Figure X, F). Either at operation or at autopsy the problem of distinguishing macroscopically between a benign and a malignant ulcer is appreciated. Through the gastro-scope, however, one has the inestimable advantage of direct inspection of a gastric wall through which blood is circulating and from which light is readily reflected. These important and decisive factors allow the mucosa to appear in its true colours, and this facilitates the differentiation between benign and malignant ulceration of the stomach. The base of the carcinomatous ulcer has not the yellow or the whitish appearance of a simple ulcer, but has a brownish, violet, deep blue, black, or rather an admixture of colours. In the benign gastric ulcer the edge is sharply defined; in the malignant ulcer, however, the transition between the ulcerated and the surrounding non-ulcerated tissue is more gradual. A ragged, friable edge with areas of hæmorrhage in a necrotic mucosa may be seen. Again, the simple ulcer is at the same level as the surrounding mucosa; whereas the carcinomatous ulcer is raised above the level of the mucous membrane. This state is due to infiltration of the surrounding tissues. Naturally at times the differentiation cannot be made.

Scirrhus Carcinoma.—A diffusely infiltrating scirrhus carcinoma of the stomach presents a characteristic picture. (The stomach in this case can tolerate only small quantities of air and can scarcely be distended.) The orderly arrangement of the normal mucosal folds is lacking, and irregularly

shaped warty masses may be seen projecting into the lumen of the stomach. There is no peristalsis, and if the anterior abdominal wall is palpated gently during the examination it will be seen that the stomach wall moves *en masse* across the visual field.¹

For early diagnosis of malignant disease of the stomach it is evident that gastroscopy is of the greatest assistance. Furthermore, the possibility of resecting a carcinoma of the stomach can be determined. By inspecting the upper border of such a neoplasm with the gastroscope its distance from the cardia can be estimated and the character of its edge examined.

Benign Tumours.—Benign tumours of the stomach are not at all rare. They seldom give rise to symptoms, though they may occasionally cause severe bleeding. Myomata, fibromata and adenomatous polypi have been described as a result of gastroscopic examination.

The Post-Operative Stomach.—If a gastro-enterostomy has been performed, the stoma is usually seen with ease (see Figure X, B). Occasionally the stoma may be seen to have a sphincteric action like the pylorus.^{(12) (17)} Schindler has observed the difference in rhythm with which the stoma and the pylorus contract when they are seen in the same visual field. In many cases the gastro-enterostomy stoma remains patulous. In these cases peristalsis may be seen beyond in the jejunal loops. On inspecting the jejunum the *valvula conniventes* are seen encircling its wall. The colour of its mucosa is browner than that of the normal stomach.

The gastroscope is a valuable aid in the elucidation of diseases of the "post-operative stomach". Before it was used as a diagnostic method many anastomotic ulcers were diagnosed by symptoms alone. It is only too well known that many patients develop gastric symptoms again after gastro-enterostomy. Undoubtedly in some cases the recurrence of pain is due to an anastomotic ulcer, but the gastroscope has shown that the most important and frequent lesion responsible for complaints following gastro-enterostomy is gastritis. It is in the "post-operative stomach" that the most severe forms of gastritis may be encountered.

If the patient has an anastomotic ulcer, the marginal ulcer is easily seen and the jejunal ulcer is visible when situated in the jejunum directly opposite the stoma.

Sometimes silk sutures are seen around the site of the anastomosis. These may be detected, either buried in the mucosa or hanging from the wall into the gastric cavity. In the latter case their friction causes an area of erosive gastritis, which continually heals and recurs. Rarely an erosive jejunitis may be seen if the gastroscope is passed

through the stoma into the jejunum. In these cases the jejunal folds are covered with erosions, giving the mucosa a ragged, moth-eaten appearance.

Chronic Gastritis.—The diagnosis of chronic gastritis is an important function of the gastroscope. For thirty years the view that this had a definite clinical existence was regarded with scepticism; but now gastroscopy has settled the question. Guided by his gastroscopical observations, Schindler⁽¹³⁾ divides this pathological condition into four groups: (a) chronic superficial gastritis, (b) chronic atrophic gastritis, (c) chronic hypertrophic gastritis, (d) gastritis of the "post-operative stomach".

1. In chronic superficial gastritis the pathological changes involve only the superficial layers of the gastric mucosa. The three characteristic features of this condition are hyperæmia, exudation and oedema. The mucosa loses its normal lustre and becomes spongy. Ill-defined hyperæmic areas, varying in size and irregular in shape, are scattered throughout the mucous membrane. Portions of the stomach mucosa are covered by layers of exudate which is airless and milky white in appearance. An excess of mucus collects between the rugæ. Generally this condition heals; but it may progress to atrophic gastritis.

2. Chronic atrophic gastritis is readily recognized through the gastroscope by the thinness and paucity of the mucosal folds (see Figure X, E). This condition first appears in isolated patches of the mucosa. The affected areas are very smooth and are slightly depressed beneath the level of the surrounding mucous membrane. The orange red colour of the normal gastric mucosa is replaced by a greenish-grey hue, through which the blood vessels of the submucosa can be seen and traced to their finest ramifications. In the normal mucosa the blood vessels are not discernible. A partial atrophy is more frequently seen than a diffuse one. In patients with pernicious anæmia the atrophy of the gastric mucosa is usually incomplete. Jones, Benedict and Hampton⁽¹⁵⁾ have observed the regeneration of the atrophic mucosa of such patients under liver therapy. The exact relationship of atrophic gastritis to the anæmias and carcinoma of the stomach has yet to be determined.

3. In hypertrophic gastritis the mucous membrane presents a swollen and velvet-like appearance. The mucosa is dull and the "high lights" produced by the light reflex from the mucosal surface are diminished. The condition is characterized by wart-like protuberance of the mucosa. These verrucous changes usually start in the valleys between the mucosal folds. Small nodules appear and proliferate to produce polygonal areas of different size, which are bounded by deep and tortuous crevices. The rugæ are involved later. A ring-like segmentation develops along the crests of the folds, and the resulting structure resembles the form of a caterpillar. In addition, the rugæ become enlarged and rigid and cannot be flattened out. These nodules may become so large that they are mistaken for

¹ In a personal communication Dr. Fred A. J. Geier, physician, of Washington, D.C., writes: "This patient had been X-rayed on three previous occasions, the last X-ray being one month ago. In all instances it was reported that the stomach and duodenum showed no abnormality. I gastroscopied him and located a friable, hemorrhagic, necrotic and ulcerating carcinoma on the greater curvature and anterior wall 'middle parts'. Six days ago this patient had an exploratory laparotomy and an inoperable carcinoma of the stomach was found."

true polypi. Sometimes the extremities of the nodes are reddened, and often small hæmorrhages are seen in these areas. The most important complication of hypertrophic gastritis is the occurrence of multiple small superficial ulcerations, oval or circular in shape, with yellowish bases and hyperæmic margins. These small ulcerations can give rise to severe hæmorrhages. Excess of mucus is not a feature of hypertrophic gastritis, although a small amount may be seen between the mucosal folds.

4. In regard to post-operative gastritis Schloss has stated: "In our material there was not a single operated stomach without considerable gastritic changes."⁽¹⁶⁾ However, Schindler has found that severe forms of gastritis do not occur in those cases in which the stoma has developed a rhythmic function like the pylorus; and that if this adaptation does not occur, severe post-operative gastritis may arise. In such circumstances all forms of gastritis, either alone or mixed, may be encountered.

Schindler⁽¹²⁾ has noticed that if the gastro-enterostomy is situated near the pylorus, then rhythmical contraction of the stoma is more frequently observed, and that after a resection operation the stoma often remains patulous. Moutier⁽¹⁷⁾ has also described this rhythmic function in a gastro-enterostomy stoma situated on the posterior wall near the pyloric antrum.

Summary.

1. The invention of the Wolf-Schindler flexible gastroscope has made possible direct inspection of the lining of the stomach.

2. The examination can be carried out with safety and with little discomfort to the patient.

3. Through the gastroscope a transverse fold is regularly seen in the cavity of the stomach. It lies between the body and the antrum, and has been named by Schindler the *musculus sphincter antri*.

4. Gastroscopy does not replace radiology. The combined use of both procedures is essential for the complete investigation of gastric disorders.

5. This method of examination allows the clinician to follow the progress of benign tumours and to observe the response to treatment of gastric ulcers.

6. The benign or malignant nature of a gastric ulcer can often be determined by gastroscopy.

7. The instrument enables one to determine the situation of and the amount of stomach wall involved by a gastric neoplasm. This is of great importance with regard to the possibility of resection of a carcinoma of the stomach.

8. "Gastroscopy has re-discovered the frequency of chronic gastritis, which has to be considered as the most frequent lesion of the stomach."⁽¹¹⁾ Schindler distinguishes four types of chronic gastritis: chronic superficial gastritis, chronic atrophic gastritis, chronic hypertrophic gastritis and post-operative gastritis.

9. Gastroscopy often discloses the cause for complaints which develop in patients after operations on the stomach.

10. The gastroscope is of the greatest assistance in the management of gastric disorders.

Acknowledgements.

I wish to express my gratitude to the members of the X ray department at Saint Vincent's Hospital, Melbourne; to Mr. W. Kilpatrick for the photography; also to Mr. J. Reardon for the excellent coloured plates.

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A DILUENT FOR DIPHTHERITIC TOXIN FOR SCHICK'S TEST.

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AND

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It has been known for many years that diphtheritic toxin, diluted in normal saline solution, tends to lose potency. It is particularly susceptible to the action of certain physical or physico-chemical agencies, such as warmth and light, and, if phenol be present, to agitation.⁽¹⁾ On this account it has been customary to supply as material for Schick's test a minute quantity of the undiluted toxin in one container and the saline solution in another, the two being mixed by the physician immediately prior to his performing the test. For many reasons

ILLUSTRATIONS TO THE ARTICLE BY DR. JOHN HORAN.

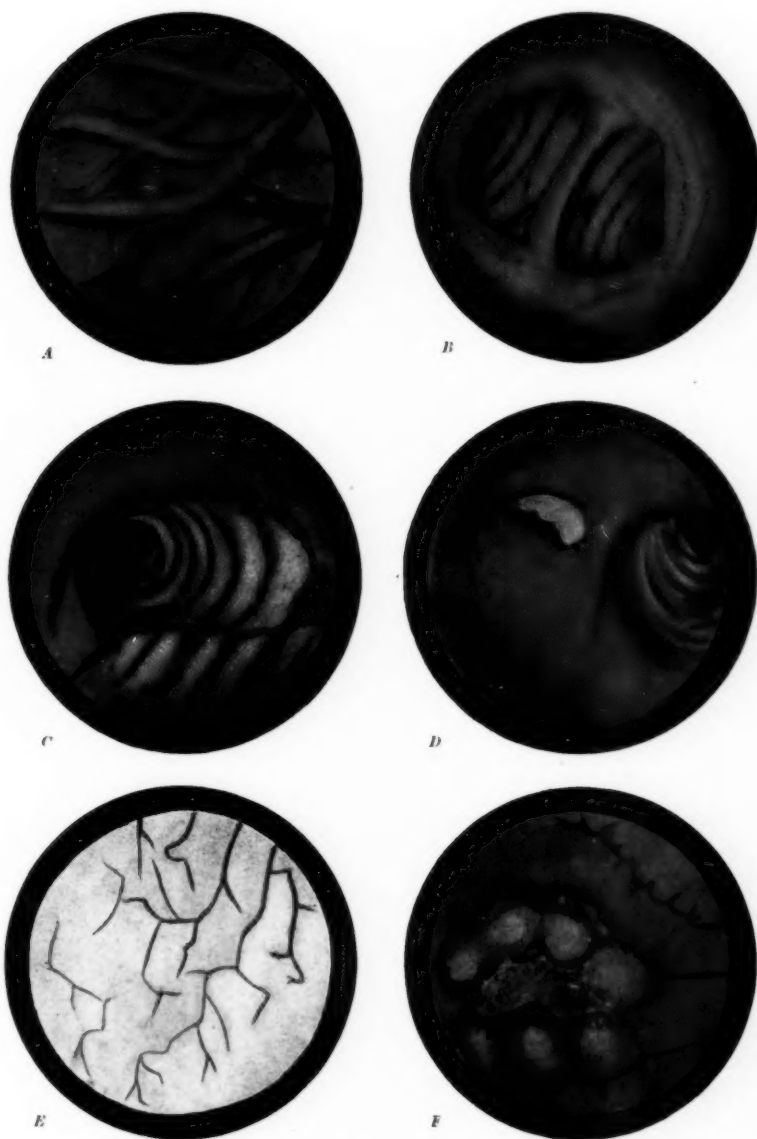


FIGURE X.

A: Normal mucosal folds on anterior wall of stomach. B: A gastro-enterostomy stoma. Both loops of the jejunum are seen. C: The rope-like *musculus sphincter ani*, with the sickle-shaped angulus above and the pylorus beyond. D: Benign gastric ulcer of the lesser curvature just above the angulus. E: Atrophic gastritis. F: An ulcerating carcinoma of the stomach.

ILLUSTRATIONS TO THE ARTICLE BY DR. JOHN HORAN.



FIGURE VI.

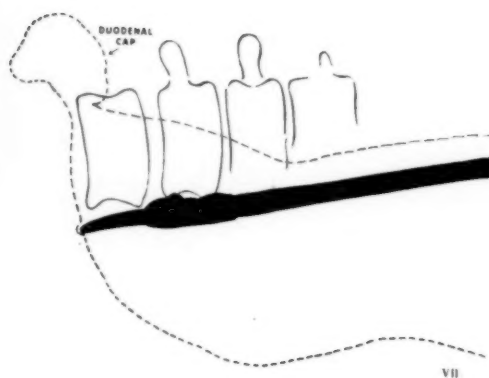


FIGURE VII.

In Figures VI and VII an antero-posterior film has been taken showing the gastroscope in position. The patient is lying on his left side and the stomach has been moderately distended with air.



FIGURE VIII.



FIGURE IX.

In Figures VIII and IX a lateral film has been taken showing the gastroscope in position. As before, the patient is lying on his left side and the stomach has been moderately distended with air.

efforts have been made to devise a diluent in which the toxin would maintain its potency intact, undisturbed by adverse influences it might meet.

In Australia, especially in summer, packages being transported by train or motor car may be subjected to temperatures of 37° C. or more on repeated occasions and for hours at a time. It is relatively far more difficult to conserve the potency of a diluted toxin at 37° C. than at ordinary room temperature (15° to 25° C.). Consequently there is demanded of a diluent destined for use in Australia, protective efficacy of an especially high degree.

Glenny, Pope and Waddington⁽²⁾ designed a "buffer" solution of borax, boric acid and sodium chloride in which certain toxins retained their potency at room temperature for six weeks, whereas the same toxins in normal saline solution lost four-fifths of their strength within that time.

Bunney⁽³⁾ preferred as a diluent, a solution of peptone and sodium chloride—a formula which was later slightly modified and more exactly described by White, Bunney and Malcolm.⁽⁴⁾

Moloney and Taylor⁽⁵⁾⁽⁶⁾ prepared a diluent consisting of a borate "buffer" (Sorensen's pH 7.9) to which was added thrice its volume of normal saline solution and a small quantity (0.02%) of gelatine. In this diluent their toxins withstood a temperature of 37° C. over a period of six days.

However, these diluents do not seem to have invariably fulfilled all the requirements desired. Thelander,⁽⁸⁾ in 1933, made a comparison of the effect of Schick test toxin diluted on the one hand in these new diluents and on the other, as of old, in normal saline solution. Both of the diluents devised by Bunney and the one devised by Moloney and Taylor were employed. A disadvantage of the new diluents became apparent. Pseudo-reactions occurred. These pseudo-reactions appeared in 16% of the children and in 20% of the adults. As regards the true Schick reactions produced, agreement occurred between the old and the new products in 83% of instances. Thelander stated, in conclusion, that the old material "freshly diluted with physiological saline solution remains the more accurate of the Schick materials".

In a subsequent publication, in 1934, Thelander⁽⁹⁾ reported the results of his tests of more recent products. These were Schick toxins diluted in diluents produced by two well-known laboratories in the United States of America. These new diluents proved much more successful, and Thelander expressed himself as practically satisfied with them. He found that when they were compared with the ordinary Schick test toxin (freshly diluted), agreement as regards true reactions was complete. Pseudo-reactions were called forth by the "ordinary" toxin in 2% of instances, by the "new" in 5%. Thelander advised that the first reading of the test in adults should be made not earlier than the fourth day, but preferably on the sixth or seventh, "allowing the early, slight pseudo-reaction to disappear". A search of the literature has revealed no

account of the composition or method of preparation of these successful diluents.

Kusama and Hata⁽⁷⁾ recommended a "buffer" solution of simple composition, to which was added 0.02% of gelatine. They found that storage for four months in the summer, in a room the temperature of which often reached 36° C., caused no detectable deterioration of the toxin thus diluted.

As recently as April, 1937, Glenny and Stevens⁽¹³⁾ have recorded their suspicion that certain of the diluents at present being used may, in a very small percentage of the recipients, produce allergic reactions. They quote Parish,⁽¹⁴⁾ who had collected or observed fourteen such reactions, some being attributed to the presence of peptone. In order to avoid this disadvantage, Glenny and Stevens proposed a diluent containing a small quantity of human serum.

The Diluent Now Adopted.

The Formula of the Diluent.

The diluent which has been found satisfactory and which has been adopted by these laboratories has the following formula. This formula is a modification of the one recommended by Kusama and Hata,⁽⁷⁾ to which reference is made above. As modified, it is as follows:

Acid boric	8.4 grammes.
Sodium chloride	15.9 grammes.
Borax	5.7 grammes.
Purified gelatine	5.0 grammes.
Distilled water	2.0 litres.

We have hitherto found this mixture to be of pH 8.0. If it proved not to be of this pH we should adjust it, since we have found this pH, or that of 8.1, to be most suitable for the preservation of our toxins.

Sterilization is effected by autoclaving at 115° C. for twenty minutes. Sodium ethyl mercurithio-salicylate to a concentration of 0.01% is added.

The feature in which this formula differs from that of Kusama and Hata is the purification of the gelatine. This purification we regard as essential.

The Method of Purification of the Gelatine.

"Difco Bacto-Gelatin" has been found suitable for purification. Its granular form renders it easy to wash. To a convenient quantity, such as 20 grammes, there is added distilled water (at 0° to 5° C.), the pH of which has been reduced to 4.75 by the addition of m/128 acetic acid. The mixture is stirred. It is not shaken lest bubbles form. The mixture is allowed to stand at 0° to 5° C. until the gelatine has swollen to its maximum and settled—a procedure which may take up to one hour. The supernatant fluid is then removed and replaced by a fresh quantity of this distilled water (at a pH of 4.75). The gelatine is allowed to settle again. This washing with acidified water is repeated twice more.

Thereafter, in the same manner, the gelatine is washed four times with freshly distilled water at a temperature of 0° to 5° C. It is then drained on a Buchner funnel. It is melted in a water bath at a

temperature from 37° to 40° C., water being added to such an extent that the final concentration of gelatine is about 20%.

This solution of gelatine is then poured into a glass bottle, the bottom of which has been replaced by a sheet of parchment. When the solution of gelatine has cooled and solidified, the parchment is removed. The gelatine clings to its position on the glass walls and the whole bottle is now suspended in a large shallow dish which contains a gently running stream of ice-cold distilled water. At the bottom of the dish, below the water, is a pool of mercury connected by a platinum electrode to the negative terminal of an electrical main arranged to deliver a direct current.

Inside the bottle, on top of the gelatine, is now arranged a gently running stream of ice-cold distilled water in which is suspended another platinum electrode, this time connected to the positive terminal of the main. In a circuit parallel to this gelatine cell is inserted a resistance box and a voltmeter. An electrical current is passed. By this current the diffusion of electrolytes from the gelatine is hastened. This current has a difference of potential at the mains of 250 volts, constant current. As the electrolytes are removed, so the resistance of the circuit increases, and there is a diminution of the volumes of gases escaping from the electrodes. At the same time the voltmeter indicates that more current passes through that circuit in preference to the more highly resistant gelatine circuit. When the difference of potential as measured by the voltmeter approaches 250 volts, the purification can be regarded as being as complete as circumstances allow.

The ash content at this stage is 0.01% to 0.02%, to which it has been reduced from the original 0.1% to 0.5%. For determination of the ash content quantities of two grammes are periodically removed, incinerated and weighed.

The gelatine is then cut into thin slices and dried in a current of air at 32° to 37° C. When dry, it is ground and stored in bottles having glass stoppers.

For the enunciation of the principles which underlie this procedure we are indebted to the writings of Loeb,⁽¹⁰⁾ of Knaggs⁽¹¹⁾ and of Northrop.⁽¹²⁾

The Stability of Toxin Diluted with the Diluent Now Adopted.

Method of Testing.

Toxin for use in the Schick test has now to conform to the requirements set forth in the Therapeutic Substances Regulations, 1931, made by the committee constituted by the British *Therapeutic Substances Act*, 1925.

These requirements are devised to ensure that the toxin shall possess not only a direct necrotic effect of defined intensity, but also a capacity for combining with and neutralizing antitoxin, which capacity must bear a quantitative relation to the necrotic effect.

Thus to quote the regulations:

The dilution of Schick toxin proper for the test is that in which 0.2 cubic centimetre contains one test dose. The test dose of Schick toxin for the purpose of this provision shall be measured by the following tests:

(1) By intracutaneous injection into normal guinea-pigs in mixtures with different proportions of diphtheria antitoxin. One test dose mixed with 1/750th or more of a unit of antitoxin must cause no local reaction, but mixed with 1/1250th or less of a unit of antitoxin must cause a definite local reaction of the type known as the "positive Schick reaction".

(2) By intracutaneous injection into normal guinea-pigs, without admixture with antitoxin. One-fiftieth of one test dose must not cause, and 1/25th of one test dose must cause, a definite local reaction of the type known as the "positive Schick reaction".

The test adopted by us in order to determine the stabilizing efficacy of various diluents is a modification of test number (2) above. The actual fractions of the test dose employed have been five, namely, 1/3, 1/6, 1/12, 1/25 and 1/50. Each fraction, made up to a volume of 0.2 cubic centimetre with normal saline solution, has been injected intracutaneously. By the use of numerous guinea-pigs and by making especially important comparisons side by side upon one guinea-pig, the possibility of erroneous results due to variation in experimental animals has been eliminated.

Test number (1) above, which measures the combining value of the toxin under investigation, has been also employed and has indicated that the combining value tends to deteriorate under unfavourable conditions, just as does the direct necrotic capacity unless the diluent employed has rendered the whole product stable.

The Results of the Tests.

The extent to which the potency of toxins is preserved in this diluent is indicated in the accompanying table. In column number 3 a number of diluents, numbers 21 to 38, are mentioned. They differ only in the amount of antiseptic which they contain. In every other respect they conform to the formula given above. The toxins, being diluted in these diluents, were distributed in quantities of ten cubic centimetres into ampoules, which were then sealed and stored, some at 2° C., some at room temperature, and some at 37° C. After the lapse of each of the varying periods of time indicated in column number 5, certain of the ampoules were withdrawn and opened. The contents were tested. The remainder of the contents was discarded. Thus each of the experiments included in this table is a separate experiment.

It will be noted, by observation of this table, that this diluent preserved the toxin for 298 days while it was kept at a temperature of 2° C. When the diluted toxin was kept at a temperature of 37° C., it remained apparently unharmed for six days; but by the seventh, on two out of four occasions a slight loss of potency was detected. By the fourteenth day the loss was on one occasion considerable.

Similar experiments, not quoted in this table, have indicated that when the toxin thus diluted is

TABLE SHOWING THE STABILITY OF TOXINS DILUTED WITH THE DILUENT NOW ADOPTED.

Experiment Number.	Toxin Used.	Diluent Number.	Amount of Antiseptic Added.	Number of Days Stored.	Resultant Loss of Potency.	
					At 2° C.	At 37° C.
1	395C-1	24	1:10,000	4	None.	None.
2	395C-1	21	1:20,000	5	None.	None.
3	395C-1	22	1:40,000	6	None.	None.
4	917B	23	1:10,000	6	None.	None.
5	395C-1	20	Nil.	7	None.	None.
6	395C-1	24	1:10,000	7	None.	None.
7	395C-1	26	1:10,000	7	None.	Slight.
8	395C-1	38	1:10,000	7	None.	Very slight.
9	395C-1	25	1:5,000	11	None.	None.
10	395C-1	22	1:40,000	13	None.	None.
11	395C-1	26	1:10,000	14	None.	Considerable.
12	395C-1	24	1:10,000	15	None.	None.
13	395C-1	21	1:20,000	19	None.	Slight.
14	917B	23	1:10,000	20	None.	Slight.
15	395C-1	21	1:20,000	26	None.	Slight.
16	395C-1	21	1:20,000	33	None.	Considerable.
17	395C-1	21	1:20,000	40	None.	Very considerable.
18	395C-1	20	Nil.	63	None.	
19	395C-1	26	1:10,000	72	None.	
20	395C-1	20	Nil.	104	None.	
21	395C-1	21	1:20,000	130	None.	
22	395C-1	30	1:10,000	298	None.	
23	395C-1	26	1:10,000	Kept for 51 days at 2° C., thereafter sent from Melbourne to Cairns and back, by post, a journey which, on that occasion, took 21 days. When it was tested on return, no loss of potency could be detected.		
24	395C-1	33	1:10,000	Kept for 190 days at 2° C. and then for 45 days at room temperature during the summer. When it was retested at the end of that time, a very slight loss of potency was detected.		

kept at room temperature it will maintain its potency intact for thirty days during a Melbourne summer (30° to 40° C.). After the expiration of longer periods—thirty-eight and forty days—it has been found to have lost potency.

The Use of the Toxin Thus Diluted as a Material for Schick's Test in Human Beings.

Diphtheritic toxin for use in Schick's test, diluted in this diluent, has by now been issued by these laboratories for a number of months past. A full report of its use in human beings is contained in an accompanying article, written by Dr. C. R. Merrillees, of the Victorian State Department of Health.

Summary.

A diluent for diphtheritic toxin for use in Schick's test has been described.

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DIPHTHERIA IMMUNIZATION: THE NEW DILUTED SCHICK FLUID.

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DURING last year a new preparation was introduced by the Commonwealth Serum Laboratory for the convenience of those engaged in Schick testing. It is an already diluted Schick toxin ready for use, and by the courtesy of the director we were supplied with sufficient to test over 5,000 children.

On account of its outstanding advantages the new diluted fluid has been adopted by this department for routine use, and the following observations and comments are offered for the information of those who have not used it.

Convenience.

It is extremely convenient, as it requires no more trouble than to clean and open the glass ampoule and fill the syringe. There is no capillary tube to clean and possibly lose in a crack in the floor or bench; there is no need to provide the whole battery of things necessary to crush and prepare the fluid; in fact, instead of the procedure requiring ten to twenty minutes, it is now a matter of seconds.

Uniformity.

Owing probably to the elimination of errors in the old procedure, uniformity in successive testings has been remarkable. The elimination of doubtful reactions is almost complete. Two hundred children, who owing to some uncertainty were completely retested, gave only two varying results with the new method, although read by two different operators; but the control with the old material, although both were read by one person, showed wide divergence in nearly forty cases. The reason for this will be discussed with the description of the reaction.

Ease in Reading.

Only one factor needs consideration, that of intensity, so that there is an almost complete absence of doubtful readings. There is no need to sum up the relative importance of area, colour areola *et cetera*, but merely to estimate the intensity of the reaction and classify it as such.

Old and New Give Parallel Readings.

Four hundred children with approximately equal doses of old and new Schick fluids showed nearly parallel reactions.

Tested with the new fluid, 23 who had given a negative response with the old method, all gave a negative response; 338 who had given a positive reaction with the old method all gave a positive response with the new, except in one instance. In this case the reaction was "doubtful, but probably positive", and the response proved to be positive when the child was retested. There were 39 doubtful reactions; 11 probably positive reactions all proved to be positive with the new fluid; six "probably negative" proved negative except one, which was a "very faint positive". Of these 39 cases in which the reaction was doubtful there were 22 remaining; of these, 15 gave a negative reaction, six a partial reaction, and in one instance the reaction was "doubtful, probably negative".

Even including the doubtful cases the parallelism is almost exact, and the ease with which a decision may be made makes the new method very reliable.

Description of the Test.

The test is done in the usual way by injecting an intradermal dose of 0.2 cubic centimetre into the forearm. The result is read on the fifth or sixth day and has a characteristic appearance.

Actually there are three stages of reaction that should be noted: (i) the immediate reaction, (ii) the second day reaction, and (iii) the fifth day reaction. To avoid ambiguity it should be noted that the day of injection is the first day—say a Monday; the Tuesday will be the second day and the Friday the fifth day.

The immediate reaction appears suddenly within a few minutes and fades just as quickly. It varies in size and intensity, and appears to have no relation to any specific reactions. Except for this mention

it is disregarded in this discussion. The other stages will be further discussed under the heading "Time Factor".

Appearance of Reaction.

Read on the fifth day, a normal Schick reaction with the new product is seen as a striking patch of redness on a normal skin. There is practically no infiltration, there is no areolar paleness and there is no tenderness or pain. The colour is best described as that of a moderate sunburn or that produced by vigorous rubbing of the normal skin. The bloom is not destroyed, so that the skin appears to be merely dyed. The most striking character, however, is the nearly constant area. Although the colour varies in intensity, the diameter is always about the same—about two centimetres. It is this lack of variation in area which has enabled us to assume a sort of numerical classification of these Schick readings, to which some reference later.

Quantitative Classification.

Although there is no strict scientific authority, but merely several supporting analogies for so doing, a classification of intensity of reaction was made. The rough classification adopted will at least be useful for descriptions in this discussion, even if it may be begging the question that intensity of reaction is proportional to want of antitoxin in the subject's blood.

As the other factors of area, colour *et cetera* were apparently so constant, it was simple to arrange the following grades. One thousand and six children were taken at random and carefully tested with Schick test fluid, Moloney test fluid and heated Schick test fluid as a control. The readings of the Schick test on the fifth day were as follows:

Grade.	Number of Cases.
0 (no reaction)	194
1 (barely perceptible)	52
2 (distinct)	81
3 (more marked)	135
4	495
5 (intense)	39
6 ("necrotic")	4
Not recorded	6

¹ Grade 6 is called "necrotic" for want of a better name. It is "necrotic" only in appearance, and so far no cases have been recorded in which anything worse has happened than a feeling of alarm when so severe a reaction has been seen for the first time.

Time Factor.

It has always been stressed that the times of appearance, the maximum point and the fading of the reaction are important in reading the result of a Schick test. Using our intensity classification, the classic course of a normal positive reaction would be something like this. On the first and second days reaction = 0; on the third day or perhaps at the end of the second day reaction = 1 or 2; on the fourth day reaction = 3 to 4. The reaction remains at a maximum till about the sixth day and gradually fades. By using a succession of

numerals to represent the grades on successive days such a course would be written thus: 00134432. There would, of course, be variations, such as 0123444 and 00044432. The characteristic of this course is the steady rise to a pointed maximum (apex type) or to a long-continued maximum, such as 02444432 (plateau type), so that the result of the test could with safety be read on any day from the fourth to, say, the seventh inclusive (Thursday to Sunday).

The most important variation noticed in the reactions to the new Schick test fluid was a remarkable remission or even total fading on the fourth day (Thursday), with a reappearance in full on the following day. The next striking thing was the large proportion of reactions which appeared on the second day or even within twenty-four hours. These were checked with heated control tests in 140 children, 138 of whom showed reactions before thirty hours and two after thirty hours. The reaction usually begins to fade on the seventh day and rapidly disappears, leaving no trace of staining and pigmentation.

The remissions were then considered. In these 140 children who all reacted to the Schick test, a high proportion of remissions was observed, at least 75%. The following statement gives the actual results; the numerals, however, do not indicate the actual readings, but are given to show the type under which each child fell.

A. Non-remission type—

(i) Apex (012344 <i>et cetera</i>)	7
(ii) Plateau (024444, <i>et cetera</i>)	9
(iii) Irregular—	
(a) (03244)	2
(b) (04242)	1
(c) (01224)	1
(d) (00004)	2
	6
Total	22

B. Remission type—

(i) (04424 <i>et cetera</i>)	79
(ii) (04224 <i>et cetera</i>)	10
(iii) Irregular—	
(a) (04324)	18
(b) (02424)	11
	29
Total	118

It was obvious that some, if not all, of this remission was due to pseudo-reaction, and this will be discussed later. It is sufficient at this stage to state that this is not wholly so, and that, when tested against a control, the actual or "net Schick-positive" reaction showed a remission in intensity on the fourth day. On account of these remissions the test should not be read on the fourth day, but on the fifth (Monday to Friday) or sixth. The eighth (Monday to Monday) is rather long, as by that day some of the fainter reactions will have disappeared.

Other Reactions.

The Moloney Reaction.

To be sure of one's readings an appreciation is necessary of the essential differences in the various reactions met in other tests. The best known is the Moloney test. This reaction is the result of intradermal injection of diluted anatoxin in hypersensitive persons and readily serves to eliminate such children from those who shall receive treatment doses. It is always used as a separate test.

The Moloney reaction appears within a day and varies widely in intensity and in area, generally but not always in a parallel manner; so that, although unusual, it is not rare to see intense reactions in a small area nor a large area slightly affected. Its appearance is followed in a few hours by its maximum state; fading begins at the end of the second day, and unless the reaction has been severe the reaction will have disappeared before the fifth day. There is staining for some days and often pigmentation for a longer time. These latter characters, including persistence, are also proportional to the severity of the reaction, and it is not rare to find the maximum condition persisting to the seventh day. On the other hand, the mildest of the reactions fade in a few hours, leaving no trace. As most children have a slight reaction, a normal positive has been arbitrarily set as a reaction of moderate severity having an area the size of a threepenny piece (15 millimetres) or more. Reactions less than this must be interpreted with consideration for both intensity and area. An intense reaction, 10 millimetres in diameter, would be considered positive, but not if its intensity were, say, half that of the normal positive reaction. This most unsatisfactory standard must be set by each operator after experience, so that the inexperienced are usually advised to be guided by area only.

The Moloney reaction itself is seen as an angry patch of inflammation, raised, firm and shiny, with an areola frequently indicating the extent of the patch when fully grown. Severe reactions look like an erysipelas, and there is often pain and tenderness and occasionally even malaise and lymphadenitis. For convenience let us contrast this with the Schick reaction:

Moloney Reaction.	Schick Reaction.
Appears during first day.	Appears second day.
Maximum 24 to 48 hours.	Maximum fifth to sixth day.
Fades quickly.	Fades more slowly.
Great variation in all characters.	Varies little, save in intensity.
No remission.	Remission frequent.
Colour: "inflamed".	Colour: "dyed".
Infiltration marked.	Skin apparently normal.
Tenderness, sometimes pain.	No pain or tenderness.
Staining and pigmentation.	Complete disappearance.

The difference in appearance of these reactions is so striking that it is almost impossible to confuse them at sight, even if otherwise the physician has been uncertain which test was which.

The Pseudo-Reaction to the Schick Test.

The pseudo-reaction to the Schick test has in the past been thought to include all non-specific reactions occurring at the site of the Schick test. The specific Schick exciter is the diphtheria toxin, and it is particularly unstable in heat. Consequently if Schick fluid is heated to, say, 82.2° C. (180° F.) for some minutes, the toxin will be destroyed. Any reaction, therefore, at the site of a test made with this heated fluid is considered to be a good indicator of non-specific reagents which are heat-stable. The one outstanding reagent remaining in this heated fluid was thought to be the same group of substances that causes the Moloney reaction, namely, the bacillary proteins unavoidably present in both the toxin and the toxoid. Until the new Schick fluid was used my experience supported this idea, for it had been generally observed that whenever a pseudo-reaction or a heated toxin control reaction to the Schick test was present there would be a fine, large, prominent reaction to the Moloney test. The pseudo-reaction, moreover, closely resembled that of the Moloney test. The use of the new Schick fluid has caused us to revise this opinion completely.

For clarity it is perhaps advisable to differentiate once more the various reactions met: the Schick, the Moloney, the pseudo-reaction to the Schick test and the heated Schick fluid control test. For brevity the last will be called the "control", and the word "pseudo-Schick" will be used only when it is necessary to distinguish it from the "control". The Schick and the Moloney reactions are readily distinguished at sight, and this important factor at once enabled us to distinguish in the controls two distinct types of reaction which were indistinguishable from the Schick, the Moloney and the mixed reactions respectively. Reverting to our 1,006 children who were carefully dosed, a large proportion of control reactions was observed.

No reaction and absentees	335
Number 1 grade intensity	240
Number 2 grade intensity	256
Number 3 grade intensity	132
Number 4 grade intensity	38
Number 5 grade intensity	5

Classing the number 1 grade reactions with the negative responses for the time being, we have 43% definite control positive reactions. There appeared to be no order or uniformity in their relationship with other reactions until those vivid Moloney-like reactions were eliminated. Ninety-two of the 1,006 children reacted to the Moloney test. Of these reactions 12 were severe, and these 12 showed a strong Moloney-like control reaction, the latter itself being about equal to the Schick reaction, which was therefore a true pseudo-reaction.

Twenty-eight moderate reactions were then studied. Six of these resembled reactions to the Moloney test, and all subjects were strong reactors to the Moloney test and their net Schick reaction was nil.

The remainder did not suggest Moloney reactions to any degree, and in every instance the Moloney reaction was less than that of the 18 first mentioned (see the next table).

It should be noted that of the 1,006 children, 721 showed some but negligible reaction at the site of the Moloney test, but these are not included. Neither they nor those with completely negative responses showed any control or pseudo-reaction at all resembling a Moloney reaction.

Table showing 92 Moloney Reactions in relation to "Pseudo-Schick" Reactions.

Degree.	Moloney Positive.	Control Positive.	Combined Schick Positive.	Net Schick Positive.
Poor	37	2	8	6
Moderate	10	1	1	0
Normal positive	27	19	22	3
Marked	6	6	6	0
Severe	12	12	12	0

In striking contrast were the remaining control reactions. They had no resemblance to the Moloney type of reaction, but on the other hand could not be distinguished in appearance from the accompanying Schick reaction, except that in most cases the control was the fainter. The control also faded earlier and was not visible on the fifth day. The cause of this reaction is somewhat obscure. Although toxin will be destroyed in ordinary dilution by a few minutes' heating, it is possible that the new dilution prevented this loss. But if it be the case that the well-buffered toxin in the new dilution can stand heat, it must be able to stand boiling for five minutes or more. A few extra controls were made with fluids boiled for five and for ten minutes without any difference in the reactions.

We shall leave the explanation for another time, with a reasonable opinion that this particular control reaction is caused by one or more of the following: residual toxin, an altered toxin produced by the heating and/or dilution, or, thirdly, something new. In actual practice it is of little account if the result of the Schick test is read on the fifth day, when most of the pseudo-reaction will have faded. Its chief importance is its relation to the remissions observed in so many Schick reactions.

The Relation of the Schick Remissions to the Control Reaction.

It can be stated at once that there is no simple or direct relationship between the remissions in the Schick reaction and the control reaction. Seven hundred and forty-nine of the seven hundred and sixty-four positive Schick reactions were observed through one week. To give full value to even the slightest remission due to a fading pseudo-reaction, all control reactions were taken into account.

The following was evident. Remissions occurred in 134 children who gave no reaction to a control test; 425 remissions occurred in children who reacted to a control test.

Conversely, 113 children, comprising the whole of the strong control reactors, 19 of the moderate reactors and 31 of those who did not react, showed pronounced remissions after the Schick test.

The table will be sufficient to show that not all the remissions were due wholly to fading pseudo-reactions.

Group.	Remissions on Fourth Day.	No Remissions.	Proportion of Remissions to Non-remissions.
Control "positive" ..	455	119	3.8:1
Control "negative" ..	134	41	3.3:1

There was a higher proportion in those who reacted to the control test, but not sufficient to take it out of the error margin. It must be allowed that the table does not give a true statement when one considers the quantity of the remission. There was no doubt that a large part of the remission in some cases was due to the fading pseudo-reaction, as indicated by the control; but there was also no doubt that considerable remission and in one case a complete intermission occurred in a subject who did not give a control reaction. Allowing for errors in testing, there is little doubt that qualitatively the table is correct.

Summary.

1. Schick toxin already diluted for immediate use on opening the package was tested on approximately 5,000 children. It is safe, reliable, gives true Schick reactions, or at least parallel readings, and is free from unpleasant sequelæ.

2. It is remarkably convenient in use compared with the old capillary packing.

3. No difficulty is met in reading the reaction. Very few doubtful reactions were observed.

4. The test should be read on the sixth or fifth day. It may have begun to fade on the eighth. Owing to a pronounced remission of intensity on the fourth day (counting the day of making the test as the first), the result should never be read on this day if reliance is to be placed on the reading.

5. In reading the test, good diffused white light is necessary, and stretching of the skin must be avoided.

6. In some cases there is an immediate reaction after the test injection. This is of no known importance and may be ignored; it fades in a few minutes.

7. Any positive reaction varies very little from the normal positive reaction in area or colour. There is a striking variation in colour intensity, which is arbitrarily classified into seven grades, including "0" or negative.

8. A normal positive reaction is about 2.0 centimetres in diameter and resembles in colour and "bloom" a moderate sunburn. It cannot be confused with a Moloney reaction (see table of differences).

9. A large proportion of pseudo-reactions are observed. They are of two types, according to whether they resemble the Moloney or the Schick reaction. The former is merely a mild Moloney reaction and is found only in those who react to the Moloney test. The other is discovered by a control of heated Schick fluid. It is of little practical importance, as it fades before the fifth day, when the true Schick reaction is easily read.

10. The Schick-like "pseudo-Schick reaction" may be caused by residual free toxin, but is more likely caused by some product of toxin and its diluent. For this reason its value is not yet known.

11. The remission of the Schick reaction on the fourth day is not due to fading pseudo-reaction only.

Acknowledgement.

I am indebted to the Director of the Commonwealth Serum Laboratories for a free supply of the new product used in these tests; to Dr. C. W. Adey for continued help and advice; and to Dr. Hilda Bull, whose comments and criticism have assisted the interpretation of the results.

SOME ASPECTS OF PÆDIATRIC ENDOCRINOLOGY.¹

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POSSIBLY one of the earliest detailed references to pædiatric endocrinology is that of Pliny (A.D. 23-79), who writes:

We find it stated by historians that the son of Euthymeres of Salamis had grown to be three cubits [five feet] in height at the age of three years, that he was slow of gait and dull of comprehension, that at that age he had even attained puberty and his voice had become strong like that of a man. We hear also that he died suddenly of convulsions of the limbs at the completion of his third year. I myself not very long ago was witness to exactly similar appearances, with the exception of the state of puberty, in a son of Cornelius Tacitus, a member of the equestrian order and procurator of Belgic Gaul.

The Greeks called children such as these *εκτράπειλοι* (freaks) and for nearly 2,000 years the world's physicians continued to add to this nomenclature for endocrine disturbances without making much advance in the elucidation of the underlying endocrinopathy. But during the past fifty years, and more especially during the last decade, our knowledge of these problems has increased with such rapidity that it is difficult for most of us to keep pace with the accumulating facts and changing theories.

Realizing that a brief description of the classical endocrinopathies of infancy and childhood would hold little interest for an audience such as this, I have decided to discuss some of our newer knowledge of endocrinology and its application to certain fields of pædiatrics.

¹ Read at a meeting of the Section of Pædiatrics of the New South Wales Branch of the British Medical Association on June 11, 1937.

Hypothyroidism.

The average pediatric text-book continues to offer detailed descriptions of classical cretinism and childhood myxedema, but rarely discusses those less obvious degrees of hypothyroidism which occur frequently in both infancy and childhood. Often these minor degrees of hypothyroidism, which respond so readily to thyroid extract, are disregarded merely because the observer does not find the classical features of frank cretinism.

Careful consideration of the following factors may be helpful in the early recognition of these disturbances: (i) a family history of dysthyroidism or other endocrinopathy, and more particularly a history suggesting some disturbance of the mother's "thyroid response"; (ii) a study of the infant for suggestive signs and symptoms, including (iii) possible radiological evidence of definitely retarded osseous development, (iv) the infant's response to thyroid treatment.

With a view to achieving earlier diagnosis of hypothyroidism in infancy, Englebach and others have studied the "thyroid response" of pregnancy, and maintain that an unsatisfactory "thyroid response" during pregnancy (evidenced by such signs as an excessive gain in weight, some thyroid enlargement, a basal metabolic rate below +10% after the third month of gestation, and possibly some "puffy pallor" of the features) prompts radiological examination of the new-born infant's knee and ankle joints, and that, if this reveals a definite delay in epiphyseal development, the infant should be observed and investigated as possibly suffering from hypothyroidism.

Obviously such an elaborate scheme of investigation is impracticable outside the larger obstetric hospitals, but in our own practice we should learn to suspect the possibility of some degree of hypothyroidism in the progeny of a mother who appears to have shown an unsatisfactory "thyroid response" at puberty or during her pregnancy, and to realize that her lack of thyroid may be responsible for an imperfect unfolding of her infant's central nervous system.

Despite the statements of most text-books that hypothyroidism cannot be recognized in the breast-fed infant of less than three months, there is little doubt that the forewarned observer will find that he frequently can recognize suggestive features in the breast-fed infant of four weeks.

Many cases of hypothyroidism in childhood are recognized for the first time after an illness, and the importance of the acute infections in this respect is receiving much emphasis in Europe at present.

That hypersensitivity to even relatively small doses of thyroid extract may be displayed by the cretin is well known, but relatively little attention has been paid to this as a prognostic sign. It seems that those infants who react promptly to small doses of thyroid and are somewhat intolerant of any increase in dosage, show much more advance in their mental development than those who do not display any intolerance. These observations, coupled with the fact that the physical and mental

response of these infants to thyroid extract do not parallel one another, lend some support to the contention that hypothyroid infants may be divided into two main groups, as follows: (i) infants suffering from mental and physical retardation, both the result of hypothyroidism, the prognosis being hopeful as regards mental development; (ii) infants suffering from varying degrees of amentia of doubtful aetiology complicated by some hypothyroidism, the prognosis being poor as regards mental development.

As estimations of an infant's basal metabolic rate are usually impracticable, we must depend on his physical and mental progress, his pulse rate, his temperature, and his weight and height curves in assessing his response to treatment. A home record of the infant's rectal temperature often proves a helpful index of his tolerance to thyroid; an unexplained rise of more than one degree suggests the need for temporary cessation of treatment, and probably some reduction in the dose.

It is interesting to note that cretins exhibit: (i) an absence of the physiological creatinuria of childhood (endogenous creatine is a normal constituent of the urine until the child reaches the age of twelve or fourteen years); (ii) an increased tolerance to ingested creatine; (iii) a restoration of the normal creatine metabolism of childhood after thyroid treatment. This return of the urinary creatine has been used by some workers in America as a means of assessing the hypothyroid infant's initial response to thyroid; apparently the normal creatine metabolism of childhood is restored, under thyroid therapy, before there is any gross increase in the basal metabolic rate.

Adreno-Cortical Virilism.

Our more recent knowledge of the physiology of the adrenal cortex has helped us to understand those interesting examples of pseudo-hermaphroditism and those varying degrees of virilism which may occur at different age periods during infancy and childhood.

The adrenal cortex, which probably reaches its maximum size in the foetus of about eight months, may be regarded as "gonadic" in origin, as it develops from the mesoblastic urogenital ridge. At birth the adrenals are usually much larger than the kidneys. The size of the adrenals at this age is mainly the result of hypertrophy of the cortex, and particularly of the so-called "androgenic zone". This "androgenic zone" probably represents the embryonic boundary tissue between the cortex and the medulla, and hyperplasia of its cells would seem to be the main factor in the production of pseudo-hermaphroditism and virilism. This tissue, in conjunction with the rest of the adrenal cortex, undergoes very rapid involution after birth, and is rarely present after the infant has reached ten to twelve months of age.

Physiologists have pointed out that this rapid involution of the cortex coincides with the infant's increase in heat production, and that some change in adeno-hypophyseal function affords the primary

stimulus. Although there is very little evidence to substantiate such theorization, the constant absence of the "androgenic zone" from the adrenals of anencephalic monsters should stimulate our interest in the hypothesis that a primary adeno-hypophyseal disturbance promotes this involution of the adrenal cortex.

Adreno-Cortical Virilism and its Modifications.

Adeno-cortical virilism is probably the result of an upset of the endocrine balance produced by hyperplasias or tumours of the adrenal cortex, and is not the direct result of an excess of cortical hormone.

The following represents an attempt at approximate classification and explanation of the various syndromes of infancy and childhood which may result from hyperplasias or tumours of the adrenal cortex.

Intrauterine Virilism.—If hyperplasias or tumours of the cortex arise before sexual differentiation has occurred, then female pseudo-hermaphroditism results; the appearance of the child and the external genitals approach the male type, but the pelvis contains uterus and ovaries. If the disorder arises later in foetal life, a less evident degree of pseudo-hermaphroditism will result.

Virilism in Infancy and Childhood.—The clinical disorders resulting from hyperplasias or tumours of the adrenal cortex during infancy and childhood may be classified as follows:

1. Classical "virilism", which occurs in females only, usually begins at about two to three years of age, and is rarely accompanied by the excessive muscular development of the "infant Hercules type".

2. The "infant Hercules type" (Parkes Weber), which occurs in males only and usually begins at about two to three years of age. These "muscular" children have a somewhat adult appearance and may exhibit some hypertrophy of their external genitals.

3. Apparent hypergonadism associated with hypertrichosis and some obesity which constitutes a syndrome which may occur in either male or female children. The apparent precocious sexual development of these children does not represent a true *pubertas præcox*; in fact, precocious menstruation so rarely accompanies this syndrome that its presence should suggest other possibilities, such as an ovarian tumour or a diencephalic neighbourhood disturbance. The obesity which usually accompanies this syndrome resembles the "heaviness" of middle-age and is surprisingly unlike the usual obesity of childhood.

It is well known that palpation, intravenous pyelography and radiological examination after the injection of air into the perirenal tissues may fail in the detection of a cortical adrenal tumour and that open exploration of the adrenals is essential. Those clinicians who have had practical experience of the operative treatment in these cases emphasize the fact that there may be only one adrenal, and that therefore careful exploration of the other side is essential.

Those rare examples of virilism which occur in female children must be differentiated from two even rarer conditions which may produce a similar clinical picture.

1. "Arrhenoblastoma" of the ovary. It is recognized that the ovary is a "bisexual" organ and that the male element is represented by the undifferentiated cells in the rete which is the homologue of the testis; hyperplasia of these cells may result in the formation of the so-called "arrhenoblastoma" ($\delta\phi\phi\eta\eta$ = male) and a resultant virilism.

2. Pubertal or prepubertal Cushing's basophilism which, unlike its counterpart in adults, may be associated with some degree of hypergonadism.

The Adeno-Hypophysis.

Some of the more recent therapeutic uses of the growth, sex and lactation hormones of the adeno-hypophysis are of particular interest to the pædiatrician and to the general practitioner.

The Growth Hormone.

About four years ago, the presence of the adeno-hypophyseal growth factor was demonstrated by Evans, who produced excessive growth in young rats by means of intraperitoneal injections of an adeno-hypophyseal extract.

Obviously this growth factor has its maximum effect on the immature animal with its open epiphyses and its ability for rapid growth. This maximum response of the immature animal to the growth hormone suggests that its tissues may have a special sensitivity to this hormone, and that this sensitivity may vary in degree at different age periods and even in different tissues. If we may assume that such "local sensitivity" to the growth hormone does occur, then it is possible that partial gigantism and hemi-hypertrophy, which many authorities regard as diencephalic in origin, may be explained on the theory that the hypertrophied tissues have developed a special sensitivity to the growth hormone. Further emphasis has been given to this possibility by the entirely different and individual responses of the young *Dachshund* and sheep dog to injections of the growth hormone. Evans points out that, if this were not so, it would be difficult to account for the "structural plasticity" of dogs in the hands of the breeder.

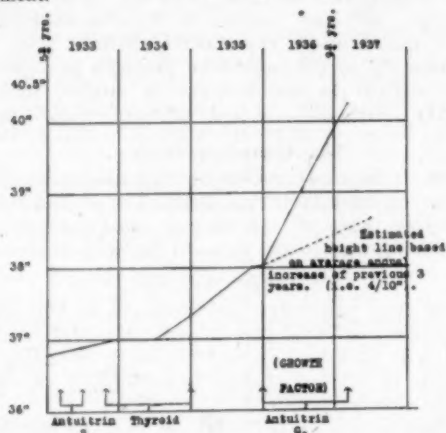
One might suggest that this theoretical sensitivity of certain tissues to the growth hormone may play some part in the production of achondroplasia. Such a suggestion would not be without scientific support, as investigators of the achondroplastic "bull dog" calf of Dexter cattle seem to favour this possibility.

The accompanying notes and four-year height curve of a case of adeno-hypophyseal dwarfism in which treatment was given by injections of an adeno-hypophyseal growth hormone ("Antuitrin G", kindly donated by Parke, Davis and Company) afford some evidence of the slight yet definite response to such treatment.

R.H. was reported to have weighed nine pounds at birth and twenty-one pounds at one year of age. At the age of five years and nine months he presented the classical picture of Levi-Lorain infantilism; at this age his height

was thirty-six and three-quarter inches, his weight twenty-six pounds, and his osseous age approximately that of a child of three or four years.

In 1932, when he was six years of age, a five months' course of injections of "Antuitrin S" was given without producing any definite increase in his height or sexual development. During the next twelve months he was treated with thyreoid, but his height increased by only half an inch, while during the next year his height increased by three-eighths of an inch without any treatment.



At eight years of age the child was given a course of injections of adeno-hypophyseal growth factor ("Antuitrin G", Parke, Davis and Company) in doses of three cubic centimetres (that is, 30 rat units) three times a week for nearly sixteen months. During this period of sixteen months the child's height increased by two and two-tenths inches, that is, a rate of approximately one and a half inches per year as compared with an average increase of two-fifths of an inch per year over the previous three-year period.

At eight and a half years his osseous age was regarded as approximately that of a child of five to seven years, and at ten and a quarter years it was regarded as corresponding to that of a child of seven to eight years. During his infancy and earlier childhood his dental and chronological age seemed to be approximately the same, but at present his dental age seems to be more closely related to his osseous age.

It is impossible to draw any definite conclusions from the response to treatment in this one case, but it suggests that injections of "Antuitrin G" will accelerate growth, even though its growth stimulating properties are disappointing from a clinical point of view. It seems doubtful whether "Antuitrin G" in its present form is sufficiently active to rehabilitate a classical dwarf of this type; but if adeno-hypophyseal dwarfism is recognized at two years of age or earlier, it seems probable that excellent results may be obtained with injections of this or other growth factor preparation, as nearly 50% of the total statural growth of the human is reached by the end of the third year.

Probably some cretins suffer from a deficiency of the adeno-hypophyseal growth hormone, and may be helped by injections of this factor to attain the full growth which they are unable to achieve with the help of thyreoid extract alone. The tendency of the cretin to develop rhachitic changes during the early stages of his treatment is well known. It should be realized that, as more potent extracts of

the growth factor become available, a similar tendency to rhachitic changes may be found in children receiving these extracts.

Little attention has been paid to the possible importance of this growth hormone in the aetiology of certain types of rickets. Bone growth is essential for the development of rhachitic changes; if this growth is hurried, as occurs during certain growth spurts of infancy and childhood, there is a much greater tendency to develop rhachitis. I would suggest that unduly rapid bone growth resulting from excess of or undue sensitivity to the growth hormone may be an important factor in the production of certain types of rickets, more particularly the mild, so-called "physiological rickets" which sometimes occurs during periods of unduly rapid growth, despite apparently adequate anti-rhachitic precautions.

The Gonadotropic Hormone.

In 1930, Schapiro introduced the use of gonadotropic hormone for the treatment of undescended testes, and since then a number of most optimistic reports have appeared in the literature. Both the variability of the clinical results and the apparent confusion about dosage which pervades many of these reports suggest that this form of therapy, although most successful in certain cases, is still in the experimental stage. I think that some of this confusion about dosage has been due to a failure to distinguish between gonadotropic pituitary extracts with an average dosage of approximately ten rat units or less, and pregnancy urine extracts with dosages of 100 to 1,000 rat units.

It seems that estimations of the gonadotropic hormone in the urine of these children might be of value in selecting appropriate cases for treatment. I have not had any practical experience of this approach to the problem, but on theoretical grounds we might assume that: (i) the presence of this hormone in the urine of a boy with hypogonadism and undescended testes would indicate some activity of the adeno-hypophysis (even though the gonadic mechanism was disturbed), and would suggest a probable response to treatment with the gonadotropic factor; and that (ii) complete absence of the gonadotropic hormone from the urine might indicate primary adeno-hypophyseal dysfunction, and would suggest the futility of treatment with the gonadotropic factor.

In 1933 I was given some of the early supplies of "Antuitrin S" and rather optimistically used this in the treatment of two boys (aged five and seven years), who were both suffering from classical adeno-hypophyseal dwarfism and hypogonadism. Although this treatment was continued for five months, neither of these boys showed any improvement in his genital development, either at the conclusion of the injections or during the next three years.

Despite the difficulties of accurate hormone assay of body fluids, and the fact that an excess or deficiency of any hormone in the urine does not necessarily indicate a corresponding excess or deficiency in the organism, I feel that the above method of approach, which depends primarily on the absence of the hormone from the urine rather

than on any fluctuation in its concentration, might prove of value in selecting appropriate cases for treatment.

I have found that treatment with "Antuitrin S" seems to produce its most spectacular results in boys suffering from bilateral cryptorchidism associated with other evidences of hypogonadism and that the results are very variable in those boys whose genital development is apparently normal except for the failure of one testis to descend. An improvement in the child's "general condition" and some increase in the size of the external genitals were almost constant findings in those boys who did respond to treatment. Probably any risk of early sealing of the epiphyses is purely theoretical, as radiological examination of the children who have responded to "Antuitrin S" has not revealed any tendency to premature epiphyseal closure.

It is extremely difficult to be dogmatic about the optimum age for the institution of such treatment or about a satisfactory dosage scheme, as both of these must vary under different conditions; possibly eight to twelve years might be suggested as the optimum age period, and 100 to 200 or even 300 units of "Antuitrin S" three times a week for three to six weeks (followed by two to three months' rest) as a satisfactory therapeutic scheme for most cases.

Prolactin.

Prolactin, the lactation hormone which probably originates in the "pregnancy cells" of the adeno-hypophysis, was isolated recently by Riddle.

To simplify the various theories which surround the problem of lactation and its initiation, we may assume that during pregnancy the excess of œstrin in the organism causes growth of the mammary tissues to a stage suitable for lactation and suppresses prolactin. After parturition, the sudden drop in the blood œstrin level probably allows the prolactin to act and so to initiate lactation. It is a little difficult to understand the so-called galactagogue function of the neurohypophysis, but it seems that this may be explained as merely the result of oxytocin acting on the smooth muscle of the breast ducts.

Last year, Ross, of the Toronto Children's Hospital, was studying the effect of prolactin injections on mothers who had failed to establish satisfactory lactation within ten days of their confinement; although optimistic, he was hesitant about expressing an opinion as to the clinical value of prolactin in these cases. The product used in this study had been prepared by Riddle, was standardized on lactating pigeons, and was given in doses of two cubic centimetres twice daily for four days.

Treatment of Gonorrhœal Vulvo-Vaginitis with Œstrogenic Substances.

In 1933, following Allen's experimental work on the effect of œstrogenic substances on the vaginal epithelium of immature monkeys, Lewis introduced the use of theelin (œstrogenic follicular hormone) in the treatment of gonorrhœal vulvo-vaginitis in infants and children. The reported results of this

treatment have been most favourable, although there have been occasional failures. At least two observers have had the honesty to point out that certain of their successes with this form of treatment may have been merely coincident, as the conversion of the immature to the adult type of vaginal epithelium was not observed.

The main problems with regard to this treatment are:

1. The possibility that harmful effects might result from the administration of œstrogenic substances to the child. Fortunately the accumulated evidence so far available does not suggest any such harmful effects, but the final answer to this question will not be available until a large series of treated cases have been observed after puberty.

2. The question of the optimum dosage for effective treatment. I hesitate to attempt any answer to this question, as my experience has been very limited and the dosage in different clinics is extremely variable. The only product with which I have had any practical experience in this field is Schering's "Progynon B Oleosum" (an œstrogenic follicular hormone).¹ As a rule, weekly intramuscular injection of 2,500 to 10,000 units of this preparation are adequate, but it is possible that smaller doses might be sufficient for many of these cases. Fortunately these injections may be limited to two or even one per week, as oily preparations such as this are absorbed and excreted slowly.

3. The question of the duration of treatment. It is a simple procedure to observe the changes in the vaginal epithelium by instilling a little saline solution into the vagina and examining the washings. Following this method it will be found that the smears are usually "negative" and the epithelium of the adult type after three or four weeks' treatment. Unfortunately a certain number of these children require more treatment than this, and others may relapse after an apparent cure. It seems advisable to continue the injections for at least another three weeks after the stage of "negative" smears and mature epithelium has been reached.

As an alternative to regular injections, some workers have tried giving œstrogenic substances by mouth or in the form of suppositories, but the results have been very inconsistent, and it is doubtful if either of these methods is of any value.

The Menorrhagias of Puberty.

I realize that the confusing problem of the menorrhagias of puberty is rather beyond the scope of this paper, and that it is almost impossible to assess the results of any form of treatment in this condition, as so many patients make a spontaneous recovery. But my own experiences with the use of the luteinizing hormone ("Progestin" or "Proluton") have been so satisfactory that I feel I am justified in emphasizing this form of therapy which may be combined with injections of pregnancy urine extract ("Antuitrin S") given during the actual period of menstruation. Theoretically, the

¹ One cubic centimetre of this preparation, which now contains 10,000 international units, was formerly declared to contain 50,000 international units.

supposedly high prolactin B content of the pregnancy urine extract has the power of increasing the luteinizing stimulus, while the "Progestin" or "Proluton" provides corpus luteum hormone.

The value of endocrine preparations in the field of paediatric practice is apparent, but the risk of injudicious endocrine therapy for the immature organism of the infant or child must be obvious. The advent of synthetic preparations has made potent hormones more fully available, and makes it even more important that they should be used with some physiological knowledge and a little scepticism rather than with the somewhat unscientific optimism which frequently wraps them.

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ACQUIRED DIVERTICULA OF THE LARGE BOWEL.¹

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VARIOUS hollow viscera and tubular structures of the body are subject to acquired diverticula. Even the large blood vessels are prone to this condition in the form of sacculated aneurysm. Diverticula are classified in two groups, congenital and acquired. Acquired diverticula may be either true or false. Those covered with all the coats of the bowel are true diverticula, and those with fewer coats and with the muscularis lacking at least in part are false diverticula, and it is with this type that this paper is concerned. The alimentary canal is subject throughout its entire length to the formation of congenital and acquired diverticula.

Acquired diverticula vary in shape from straight tubular canals to flask-shaped pouches with narrow necks connecting the lumen of the bowel, and about five centimetres to about three centimetres in diameter. They are frequently spoken of as mucosal hernia, since they are the result of a protrusion of the mucous membrane through openings in the muscular wall.

Opinions on the causation of acquired diverticula are extremely numerous. Some of the causal factors cited are: obesity, cachexia with its attendant absence of fat, normal structure of the large intestine, the physiological rôle of the sigmoid flexure, intraintestinal pressure, the relationship of the sites of diverticula to points of entry of vessels

through the intestinal wall, variations in the size of the blood vessels as a result of varying blood pressure in general circulatory disorders, congenital predisposition with regard to the amount and laxity of the connective tissues surrounding the blood vessels, and muscular deficiency of the intestinal wall. Apparently no single factor explains the origin of these diverticula, but the process results from a summation of several factors.

The more common type has already been referred to as a mucosal hernia, and the same factors which contribute to the production of typical herniation elsewhere in the body operate in the creation of these processes in the large bowel. These common factors may be briefly recapitulated as follow: first, insufficient resistance of the containing wall; secondly, increased pressure from within. Diminished tone of the intestinal musculature caused by general degenerative changes, debilitatory diseases and senility, and congenital muscular insufficiency are suggested as further provocative factors.

That pressure from within is present in the large intestine is evident from the function of this division of the digestive tract and, as is well recognized, this force is frequently accentuated by abnormal accumulations of gas and stasis, especially in the sigmoid flexure.

The rarer type of acquired diverticula in which all the mural layers are involved result from the effect of a localized weakening of a sacculum, together with traction by adhesions from without or by exaggerated pressure upon this point from within.

All the earlier authors have described the relationship that frequently exists between the presence of diverticula and the *appendices epiploicae*, and it is suggested that this is due to the fact that these fatty masses are situated at or close to the points where the large vessels enter the intestinal wall, since they are the terminations of bands of fat extending from the mesentery and from the coverings of these vessels.

The pathogenesis may be briefly summarized. The most common type consists of a protrusion of the mucosa and submucosa through the muscular layer of the bowel. This protrusion varies from straight tubes with large sufficient openings to those with a flask shape constricted at the neck by the perforated muscular layer with the bulged-out body beneath the serosa. They are therefore foci for the lodgement of faecal matter. Stasis of this faecal content depends on the neck of the protrusion. The presence of this faecal content with its accompanying infection and the dilation of the diverticula result in a thinning of the walls of the actual sac to such an extent that at the very least there is a leakage of toxins and bacteria through the mucosal layer. This leakage brings about a reaction which produces the most constant pathological process arising from infections from diverticula, namely, a chronic proliferative extramucosal infiltration, which is known as peridiverticulitis. This in turn creates

¹Read at a meeting of the Victorian Branch of the British Medical Association on May 29, 1937.

tumefaction leading to stenosis of the lumen of the bowel.

Other pathological phenomena arising may be: (a) catastrophic general peritonitis resulting from a perforation of atrophic wall of the sac; (b) acute or gangrenous inflammation of the diverticulum, with symptoms on the left side closely simulating appendicitis on the right; (c) perforation followed by localized abscess; (d) adhesions to neighbouring structures; (e) perforation or local abscess formation leading to entero-sigmoidal, cutaneo-sigmoidal, and most frequently vesico-sigmoidal fistulae; (f) an associated metastatic suppurative process in the liver; (g) carcinomata; (h) chronic mesenteritis resulting in thickening and kinks with a resultant volvulus.

A brief résumé of the history of the recognition of diverticulitis as a definite pathological process may be of interest. In 1853 Virchow published a paper entitled "Isolated Circumscribed Adhesive Peritonitis of the Colon". He noted the local inflammatory changes in the intestinal wall in its serous covering, mesentery and surroundings. Further, he called attention to the possibility of sequelae.

Little attention was paid to Virchow's observations, and it was not until 1889 that a German pathologist named Windscheid described three cases of acute exudative inflammation involving the entire ascending colon. In the following years several cases of this condition were reported by numerous writers as having been found at operation or at necropsy, but their aetiology was not understood.

Graser, in 1899, was the first to demonstrate the association of acquired diverticula with a left-sided peritonitis. One of the first articles in the English language was published in 1904 by Beer, who referred to the work done in Germany. In the same year Moynihan read before the Clinical Society of London a paper entitled "The Mimicry of Malignant Disease of the Large Intestine", which referred to diverticulitis.

The few cases reported before 1914 were all diagnosed on the operating table or at necropsy, but in that year began an era of radiological diagnosis of the condition. Carman was unable to account for several small shadows outside the lumen of the bowel after barium had been given. The possibility of multiple diverticula was suggested and laparotomy confirmed the diagnosis. After the publication of an important article by Maxwell Telling in 1917, the disease was generally recognized.

Clinically, the condition may be subdivided into four main groups, as was suggested by W. J. Mayo in a paper on diverticulitis of the large intestine published in *The Journal of the American Medical Association* in 1917. The first group he defines as self-limiting diverticulitis and peridiverticulitis. These diverticula usually occur in fleshy, middle-aged persons suffering from an acute sensitive tumefaction in the left iliac fossa. The mass is often more apparent than real, but if it exists, gradually

disappears in the course of a few days, with accompanying diminution of symptoms. These consist mainly of generalized abdominal pains, tending to radiate and later to become localized in the left side of the abdomen. These intermittent pains may occur over a long period. They may or may not be accompanied by occasional bouts of pyrexia. There is always a history of chronic varying constipation, associated in certain cases with tenesmus. Although the process may appear to be chronic, there is very little loss of weight, and the stools are not abnormal. There is a tendency to relapse, quite like that observed in chronic appendicitis.

That diverticula do not always cause trouble is shown by the relative frequency with which they are found on laparotomy, at necropsy, or by a routine radiological examination of the digestive tract. These symptomless diverticula are referred to in modern nomenclature as "diverticulosis".

The second group Mayo classifies as inflammatory diverticulitis and peridiverticulitis with associated phenomena, such as perforation, peritonitis, and local abscess formation, causing entero-vesical, entero-cutaneous and other types of fistula.

In the third group, obstructive symptoms determine Mayo's definition. The condition described is practically identical with that of either the first or second group, or of both, with the addition of tumefaction. In acute diverticulitis this tumefaction is caused by infection and oedema; in chronic diverticulitis it is brought about by hyperplasia, adhesions and angulation.

Mayo's fourth group consists of carcinomata developing on a diverticulum. In view of modern theories it is debatable whether this group can be identified. Mayo recognized the relationship between carcinomata and diverticula as being so definite as to make it reasonable to assume that infection and irritation by faecoliths in diverticula were the cause of chronic irritation and "precancerous" change. The only point of importance in the aetiology of carcinomata is the relation to chronic irritation. Mayo uses the term precancerous to denote certain cell changes taking place in the area of chronic proliferative extramucosal infiltration already referred to.

Relatively recent studies, however, indicate that carcinoma developing on a diverticulum is rare. Fallon, in a review of 1,800 cases of diverticulosis of the colon observed at the Mayo Clinic, found 625 cases of diverticulitis. There was an associated carcinoma in only 0.5% of these.

While a tentative diagnosis is suggested by the history of the illness, that is, by its length, by its intermittent nature (possibly including leucocytosis with an associated pyrexia), by the absence of loss of weight, and by the comparative normality of the stools, in many cases a positive diagnosis can be made only after radiological examination. This is best carried out by giving a barium enema, and it is essential that the colon be filled as completely as possible. Careful study will reveal areas of localized narrowing of the lumen of the colon, with

a spasticity indicative of extracolonic pressure. There may be revealed the classical bud-like masses which protrude from the lumen of the colon and which retain some of the barium mixture after the mass has moved on.

Sigmoidoscopic examination is of value in a negative sense, in that it will often eliminate primary malignant disease of the lower bowel.

The differential diagnosis is difficult, as the condition may mimic any intraabdominal pathological process, but sigmoiditis from other causes should be considered. Tuberculosis of the sigmoid occurs, but is rarer than tuberculosis of the caecum; this applies primarily to the hyperplastic form of the disease. Actinomycosis should be mentioned, as it may occur in the sigmoid region.

Treatment.

In our first group the treatment is at first prophylactic. In the symptomless types of diverticula, patients should be warned of the necessity for careful hygiene of the gastro-intestinal tract; this will prevent some of the inflammatory extramucosal reactions. All foci of infection must be removed. If mild symptoms are recognized early, conservative therapy is indicated in the form of rest in bed, with the administration of morphine or belladonna. Copious mineral oils should be taken orally.

A correct diet should be instituted; my usual procedure is to put my patients on to one of the diets used in the treatment of gastric ulcers.

Colonic Lavage.

Since the object of colonic lavage is to wash out the retained faeces, it does not matter what lotion is used. It is necessary to repeat the procedure until the fluid returned is clear. Care should be taken not to have too high a pressure of fluid, in order to prevent over-distension of the colon. In some cases the lavage must be done daily, in others weekly, and so on according to the remissions that may occur.

If an intraabdominal crisis occurs, surgical intervention is necessary. The actual technique employed will depend entirely on the pathological phase existing at the time of laparotomy. In the main, preliminary drainage of the bowel, with or without drainage of the peritoneal cavity, is indicated. If conditions are favourable, the first is best obtained by creating a mid-colic anus, and the method suggested is that described by Devine in a paper published in *The Australian and New Zealand Journal of Surgery* for January, 1934. In this article the writer stresses the conditions which govern the safety of operations on the left part of the colon, and he has adapted his technique to these conditions. The principles he establishes are, first, that extensive resections and sutured anastomoses can be safely made on the distal part of the colon if it is first rendered functionless and kept so for some time; secondly, he maintains that a mid-colic anus can be so constructed that it will in turn (a) drain an obstructed bowel, (b) completely deprive the distal part of the colon of its

function, (c) permit the early restoration of this function, and (d) close with very little operative interference.

In the surgery of diverticula and their complicating inflammatory sequelae, the complete elimination of the affected colonic area serves a twofold purpose. It causes the inflammatory reaction to subside, so that the actual limits of the diverticulum-bearing area may be recognized. On the other hand, after extensive resections, which are often necessary, it permits of a safe anastomosis being made between segments of bowel which originally were devitalized by the effects of inflammation.

With an artificial anus so created and the diseased portion of the colon not functioning, the stage is set for further surgical repair in the form of a resection of the involved colon and the establishment of the continuity of the bowel.

Before concluding, I would beg permission to describe briefly some histories of diverticula of the large bowel.

CASE I.—In 1927, a woman, forty years of age, consulted me. She had a history of having had for the previous four weeks severe abdominal pains associated with an increasing degree of constipation; and she had lost weight as the result of anorexia. Her bowels had not acted for two days. On examination the patient was a sick woman with a mass palpable at about the level of the umbilicus, on the left side of the abdomen. In the next twenty-four hours her obstructive symptoms became very acute, necessitating a caecostomy. This functioned satisfactorily, and fourteen days later I resected a circumscribed inflammatory tumour along with portion of the transverse colon and the whole of the descending colon. An end to end anastomosis was completed. The patient had an uneventful convalescence.

At the second operation, a multinodular subperitoneal fibromatous condition of the patient's uterus was discovered. Several of the fibromata were in an advanced stage of necrobiosis, which was reported as inflammatory. Later I advised the patient of their presence and suggested a hysterectomy. She came in next about two years later to make an obstetrical engagement; this was successfully maneuvered and the patient has been in the best of health since.

CASE II.—A woman, seventy-three years of age, was seen by me in June, 1932. She complained that she had suffered from generalized abdominal pain for the past few years. She was well nourished and, apart from the history of the pains, there was nothing of clinical interest to be found. Her bowels acted every alternate day with the assistance of cascara. Radiological examination after a barium enema revealed well marked diverticula throughout the patient's left colon, with an area of stenosis in the lower sigmoid region. She was treated by bowel "wash-outs" combined with paraffin oil, two drachms, taken three times a day, and was put on a non-residual diet, with resulting freedom from most of her pain. She was seen again in May, 1933, suffering from pain which had become more severe than that of her previous attacks. She also had tenderness over the lower part of the left rectus muscle. She was admitted to hospital and the former treatment was repeated. The pain persisted and the patient was actually in hospital six weeks. On returning to her home she persisted in the routine treatment for some months. In 1935 she had a recurrence which appeared to be due to an acute or a chronic obstructive process. The patient refused to come into hospital, and after some weeks of the former routine treatment the condition quietened down. In 1936 another attack occurred, and the patient became very ill with all the symptoms of an acute obstruction. She had a very stormy passage for some six weeks, but at the present time is comparatively free from symptoms.

CASE III.—My next case was a much more dramatic and fulminating one. I saw in consultation with Dr. Harbison, of Nathalia, a patient, forty years of age, who had gone to bed quite well the night before. He was awakened at 3 a.m. with severe abdominal pains accompanied by vomiting. The pain persisted and became worse, and Dr. Harbison, who saw him later in the morning, diagnosed the condition as a general peritonitis. I explored the patient's abdomen in the afternoon and found a general exudative peritonitis; the whole of the left side of his peritoneal cavity was matted together. His condition on the operating table was far from satisfactory, and I closed the abdomen after draining the pelvis and left colonic gutter. The patient collapsed completely and died at 3 a.m., after an illness of twenty-four hours' duration.

This patient had a general infective peritonitis resulting from a perforation of a diverticulum situated somewhere along his left colon.

CASE IV.—Dr. de Lacey of Tocumwal, called me in consultation to see a male patient, seventy-five years of age, with a view to performing a colostomy to relieve an obstruction due to a huge mass in the pelvis. On laparotomy I found the whole of the lower part of his abdomen full of putrid fluid, with coils of small intestine, left colon and bladder all matted together. I drained his pelvis suprapubically as well as rectally. Convalescence was stormy; an anal fistula established itself almost at once, and copious drainage persisted for weeks. However, the patient left hospital and was last reported as living a very active life.

CASE V.—The next patient was a male, sixty-three years of age, who complained of vague abdominal pains and constipation for the past seven or eight years. Recently the pains had become more pronounced. He was a very stout man, but on deep palpation some sensation of a mass arising from his pelvis was discernible. Nothing was palpable *per rectum*. A barium enema was given, but Dr. A. L. Bennett reported that only eight ounces of the barium could be run in. After a barium meal had been given, radiological examination revealed a diverticulosis of the left colon, with a stenosis of the lower sigmoid colon and an accompanying diverticulitis. Operation was suggested, but the patient went back to his home to carry out the routine treatment described in this paper, with the promise to return if his symptoms became worse. He had been very free from any such disturbance with the exception of a slight recurrence when he has taken liberties with his diet.

CASE VI.—In June, 1934, a male patient, forty-five years of age, consulted me on account of abdominal pains which had been recurring from some two months. He also had tenesmus which had recently become more noticeable. His temperature was 37.8° C. (100° F.) and tenderness was present over the lower part of his left rectus muscle. Radiological examination after a barium enema was given revealed definite stenosis at the lower end of the sigmoid colon, as well as diverticula along the length of the left colon. He was placed on treatment as outlined above, but the condition proved very obstinate. The patient, however, persisted in carrying out this treatment. In November he had every appearance of being threatened with acute obstruction, but was very averse to surgical interference. This obstruction was gradually overcome, but the patient did not become free from pain and was not able to leave his room until March, 1935. He has enjoyed very good health from that time up to the present.

CASE VII.—A male patient, fifty-five years of age, consulted me in February, 1936, complaining of generalized abdominal pains for the past seven years. These attacks were often relieved by liquid diet. A bilateral inguinal hernia had been present for the past fifteen years. He consulted Mr. Victor Hurley, who had a radiological examination made; the films revealed a diverticulitis of the patient's colon. A double herniotomy was performed, and Mr. Hurley instituted the *régime* of treatment for

diverticulitis which the patient has carried out since. He has had three or four severe attacks during the past twelve months, but these have been relieved by intensive lavage.

Acknowledgements.

I am indebted to articles published by Mayo, McGrath, and Massoon, in the "Collected Papers of the Mayo Clinic", and to the article by Devine already referred to. I am grateful to my various consultant colleagues who have given me permission to report these cases. Last, but not least, I am indebted to Dr. A. L. Bennett for her assistance in taking the majority of the photographs.

Reports of Cases.

A CASE OF ELECTRIC SHOCK WITH EXTENSIVE INJURIES REQUIRING IMMEDIATE AMPUTATION OF THE LEFT ARM AND RIGHT LEG.

By JOHN D. BEGG, M.B., B.S.,
Korumburra, Victoria.

On November 6, 1936, a linesman, aged twenty-three years, employed by the State Electricity Commission, while working with a companion on the low tension circuit, fifteen feet up a wooden pole, placed a hand, thought to be his right, on a conductor, situated well above his head, carrying 22,000 volts. His workmate stoutly maintains it was his right hand with which he made contact. There was a flash and he fell to the ground unconscious. When seen twenty minutes later, he had regained consciousness, and an examination revealed the following terrible injuries.

The left forearm, which was very swollen and blistered, was held with the elbow immobile and semiflexed and the wrist and fingers hyperextended. The palm of the hand and fingers were charred and there appeared to be complete coagulation of all tissues to well above the elbow joint. Above this the arm showed numerous deep burns, chiefly on the inner side, some of which extended well into the axilla. There was a small area of normal skin over the left deltoid, but distal to this level there was complete loss of function both motor and sensory in the charred remains of the left arm. The right foot was extensively charred on its dorsum, the first and second cuneiform and navicular bones being exposed. The ankle was immobile. The sole of the foot was bluish, with sluggish capillary circulation still persisting. There were numerous deep burns extending up the leg and surrounding the knee joint, which had a fair range of voluntary movement. Some sensation was present in a small area of skin over the calf. More superficial burns extended up the front of the thigh and on to the abdomen.

The left foot had a single deep burn almost exposing the metatarsophalangeal joint of the great toe and extending more superficially on to the dorsum.

The right hand, with which he apparently made contact with the conductor, had a superficial burn on the back, and in addition there were two slightly deeper burns on the volar aspect of the wrist and elbow. The hand and fingers over the area of distribution of the ulna and median nerves were anæsthetic, while sensation over the forearm was normal. There was loss of power in the small hand muscles, but normal power in those of the forearm.

The patient's general condition was surprisingly good, the pulse rate being 102 and its volume good. Considerable pain was present in the right leg, but only a little in the badly damaged arm.

To deal with two such hopelessly damaged limbs double amputation appeared to be necessary. Before this step was

finally decided upon, the patient was watched for a few hours while treatment to combat the shock was instituted. An antiseptic dressing was applied to the gross injuries and "Tanafax" to the more superficial ones. In three hours' time the capillary circulation which had been present in the sole of the right foot immediately after the accident was no longer in evidence. Both foot and ankle were cold, as were the whole of the left forearm, elbow and hand. A consultation with Mr. Victor Hurley was held and a double amputation was decided upon.

With the patient anesthetized by gas and oxygen, administered by Dr. R. Howden, Mr. Hurley disarticulated the left shoulder joint, excising the deep burns of the axilla and utilizing the flap of healthy skin over the deltoid to close the wound. A supracondylar amputation of the right thigh was then performed, the best obtainable flaps being fashioned from the extensively damaged skin.

It was decided to treat the left foot conservatively, allowing the area of gangrene to declare itself.

Considerable shock was naturally evidenced after such an extensive procedure, the systolic blood pressure being 85 millimetres of mercury. One pint of compatible blood was infused into the left saphenous vein, and an hour later the systolic blood pressure had risen to 110 millimetres of mercury, and no further real anxiety as to the patient's general condition was experienced.

After passing 25 ounces of normal urine the day following his operation, the patient developed a retention, and on catheterization of his bladder a large quantity of smoky urine was withdrawn. A considerable quantity of blackish deposit passed through the catheter after the evacuation. Microscopic examination of the urine revealed the presence of blood. Catheterization was necessary for about four days, when normal control was regained. The blood in the urine steadily diminished and no further urinary troubles were recorded.

During the next few weeks the shoulder healed practically by first intention, but the numerous deep sloughs in the flaps of the thigh delayed its healing. This, however, healed completely about two months after the accident.

Six weeks after the accident amputation of the left great toe became necessary.

About this time the right hand showed gross weakness of its intrinsic musculature, with atrophy of the thenar and hypothenar eminences and also of the interosseous muscles. The area of anesthesia remained limited in the volar aspect of the fingers and palm of the hand. Sensation was showing signs of returning to these areas about two months after the injury, and a fortnight later slight evidence of recovery of muscular power was detected.

It is an interesting point that the hand with which the conductor was apparently grasped, making good contact, suffered only minor burns, but sustained an interruption in the conductivity of the ulnar and median nerves, while the limbs in contact with the wooden poles into which the current passed suffered gross charring and coagulation. The nerve lesions were showing definite signs of recovery when the patient was discharged and improvement in the hand is still being maintained.

The wooden pole was burnt to the depth of a quarter of an inch.

The bladder condition was presumably caused by the passage of the current through the viscous, with resultant bruising of the mucosa. There was no sign of bruising in the abdomen to suggest a traumatic injury to the bladder sustained in the patient's fall, though this, of course, must remain a possibility. The condition was fortunately not serious.

Summary.

1. A case of severe electric shock, necessitating immediate amputation of the left arm and right leg, with recovery, is described.
2. Loss of conductivity of the ulnar and median nerve in the hand grasping the conductor is noted.
3. A suggestion that the passage of a high voltage current through the bladder may have resulted in mucosal bruising is offered.

Reviews.

BRITISH DIET.

A CAREFUL study of a recent publication, "What is Wrong with British Diet?", by Harry Campbell, M.D., leaves us with a feeling of disappointment.¹ Following as it did on the heels of Sir John Orr's "Food, Health and Income", we rather expected an amplification of those research studies, but instead, the book turns out to be a thinly veiled and much padded attempt to bring back into the scientific limelight the hypothesis of Miller in relation to dental decay. "The teaching", the author writes, "that safety from decay is to be sought for by building up teeth capable of offering an active vital resistance to the initiation of decay is erroneous."

We readily agree with him that masticatory exercise is of very great importance in ensuring adequate development of the jaws and teeth, but we find it difficult to agree with his sweeping condemnation of the nutritional factors.

In his introduction, he states: "If the mouth, including, of course, the teeth, is kept consistently clean between meals the teeth cannot decay." This is another version of the blind optimism contained in the maxim: "A clean tooth never decays", an ideal of oral hygiene which is screaming with fallacies. We have no wish to belittle the value of oral hygiene in preventive dentistry, nor do we wish to belittle the relationship of dental structure to dental function, but it would be scientific blindness to refuse to accept the growing mass of evidence which associates nutritional deficiencies with dental decay. And we would surely negate a mass of scientific evidence if we agreed with him in his statement in the introduction that: "If British children were provided with food not better in nutrient quality than it is today, but which afforded adequate use of the jaws and leaving clean mouths, the great majority would have well-grown jaws, regular well-ground and well-spaced teeth, while there would ensue an almost entire freedom from dental decay."

The repeated reference to the need for "well-baked crusty bread" which compels adequate mastication, while excellent in itself, rather suggests a theory of dental disease based upon an exclusive dogma, an attitude which is not consistent with the state of flux through which the subject is passing. The list of contents appears to be most comprehensive and traverses many fields, from eugenics through the solar spectrum to dental attrition. While providing an interesting pot-pourri, the author does not write anything under any of these headings which has not been written very much better elsewhere.

FLUORINE INTOXICATION.

FLUORINE, which most of us remember as a curious finding in the enamel of the teeth and in the form of hydrofluoric acid, useful for etching glass, has in recent years appeared as an industrial poison and as a hazardous ingredient in certain water supplies. Mottled enamel in man was described by Black and McKay, 1916, and since then the condition has been reported in several countries.

In 1931, Smith, Lantz and Smith demonstrated the cause to be a high fluorine content in drinking water. In 1932 chronic poisoning with bone conditions was described in cryolite workers by Fleming, Moller and Gudjonsson. Cattle also may suffer from a similar condition. Roholm has been following up cryolite poisoning in man and in a brochure² gives his conclusions, together with a comprehen-

¹ "What is Wrong with British Diet? (Being an Exposition of the Factors Responsible for the Undersized Jaws and Appalling Prevalence of Dental Disease Among British Peoples)", by H. Campbell, M.D.; 1936. London: William Heinemann (Medical Books) Limited. Double foolscap 8vo, pp. 267, with illustrations. Price: 10s. 6d. net.

² "Fluorine Intoxication: A Clinical-Hygienic Study, with a Review of the Literature and Some Experimental Investigations", by K. Roholm; 1937. Copenhagen: Nyt Nordisk Forlag; London: H. K. Lewis and Company Limited. Imperial 8vo, pp. 375, with illustrations.

sive analysis of the literature, the clinical investigations of cryolite workers, animal experiments *et cetera*. His treatment is most exhaustive and thorough. Fluorine and fluorides are coming into increasing use as insecticides and vermicides, for example, against cockroaches and rats, and acute poisoning has been recorded. Cryolite is an anhydrous double fluoride of sodium and aluminium, a rare mineral mined in Greenland and treated at Copenhagen. It is chiefly used as a flux in the production of aluminium, but also in the making of enamels and of glass. The dust produced in its purification is inhaled by the worker and affects all bones, causing a diffuse osteosclerosis readily showing in the X ray photographs; osteomalacia may occur and also pulmonary fibrosis. While the teeth and lung conditions are permanent, the bony changes become less pronounced with the cessation of contact with the dust. Public health measures and control are outlined. Altogether this work should be in every reference medical library and in the hands of every radiographer and industrial physician.

DEPOPULATION IN GREAT BRITAIN AND THE DOMINIONS.

Dr. G. F. McCLEARY, sometime a senior officer in the Ministry of Health, and for over thirty years a student of social problems, has produced a lucid and compact statement on the menace of depopulation, not only in England, but also in the dominions.¹ It can be recommended to anyone who seeks a sound introduction to the subject. It is of real interest to those who have made a study of the position. The author's chapters on Australia and New Zealand show him to be well informed concerning these lands on the fringe of the Empire. Dr. McCleary uses Kuczynski's findings—first, the gross reproduction rate which indicates the number of girl babies born on the average during the child-bearing period compared with the number of women during that period, and, secondly, the net reproduction rate, the number of girl babies in the next generation which will be born to the girl babies of this generation.

The gross reproduction rate of the mothers in 1933 in England and Wales was less than unity, 0.845, and the net reproduction rate, presuming conditions then existing remained constant, was 0.734. One thousand women of today mean 845 women in the next generation, and 1,000 girl babies of today 734 girl babies of the future. The road to extinction is therefore open, and calculated on this basis and taking due note of mortality trends, the population of England and Wales, 1931, of 40 millions will cease to increase in 1943 at 40,655,000, fall to 31½ millions in 1975 and 4½ millions a century from now. This assumes no migration to or from the homeland. Australia has a net reproduction rate of 0.976 and "now stands at the parting of the ways" . . . "She has special reasons for increasing her population. The Mother Country has still sons and daughters to spare for overseas settlement, though we appear to be rapidly nearing a time when that will no longer be true. But the chief need is an increase in the native-born. Australia produces splendid boys and girls. It is a pity there are not more of them." While he accepts the policy of White Australia, the author points out that the necessary corollary is the peopling of the continent, and now that the flow of migrants has dwindled this means an increased birth rate. New Zealand, South Africa, with its "poor white" problem, Canada and its French speaking section, each receive special treatment.

As an explanation the author favours Dumont's theory of social capillarity. In modern democracy ambitious striving for advancement acts as a toxic principle for the dissolution of social solidarity; and in the worship of the cult of the individual, *pour monter vite et haut il ne faut pas s'embarrasser de bagages*, in other words, the higher the standards, the lower the fertility.

¹ "The Menace of British Depopulation". By G. F. McCleary, M.D.; 1937. London: George Allen and Unwin Limited. Crown 8vo, pp. 148. Price: 4s. 6d. net.

The quest for more babies is followed from the time of Polybius, in Greece, during the second century B.C. down to the strenuous efforts of the dictators of today to increase the birth rate of their peoples. The book is a valuable contribution to social science.

SURGICAL ANATOMY.

THE aim of Grant Massie, author of "Surgical Anatomy", is: "To present the facts of anatomy in conjunction with their clinical application and, by clothing the dry bones with life, to encourage the student to keep his interest in the subject during his surgical appointments, and to enable him after qualification to refresh his memory on such anatomical problems as may arise."

Perusal of the book does not convince the reader that the author has altogether succeeded in his aim. To present the facts of anatomy in conjunction with their clinical application would require a much larger volume than Mr. Massie's book. We suspect that this work, like many others of the same title, has come into being because students have to pass an examination in the fourth year of their course in the subject known as surgical anatomy. Mr. Grant Massie does not define surgical anatomy.

There are many pages of descriptive anatomy with no surgical application whatever, a *précis* as it were of pages of standard works on anatomy.

The student is informed as to the method of preparing for such advanced operations as excision of the rectum and sympathetic ganglionectomy. These might be omitted.

There is not enough evidence in the work of the live and fresh outlook that should help the student to an appreciation of the knowledge of surgical anatomy of the living; for example, a chapter on the surgical anatomy of fractures would be useful.

In the anatomy of surgical conditions as met with in practice the work could be improved; for example, no mention is made of the work of Martin on the shoulder joint or of Walsley on the abdominal wall.

However, it must be admitted that the above criticism applies to most works similar to Mr. Massie's. Mr. Massie's book compares very favourably with these works. He deals in a capable manner with various questions that examiners put to students. Much of the work on the application of anatomy to surgery is well done, but it could be improved by illustrations of the operative approach to joints and the long bones. Such new illustrations could well replace old stock pictures that appear in so many works.

Mr. Massie's book is well printed, of reasonable size and well illustrated, and the author deserves congratulations on having included in his work a number of plates from Taylor's "Operative Surgery". These illustrations (though little known in this country) are of high artistic value, portraying very graphically the various aspects of the subject.

THE COLON AND RECTUM.

"THE DIAGNOSIS AND NON-OPERATIVE TREATMENT OF THE DISEASES OF THE COLON AND RECTUM" is a combined production by three authors, Professor Gottwald Schwarz, of Vienna, who is evidently responsible for the radiological sections, Dr. Goldberger, of Carlsbad, and Dr. Crocker, of New York, who deal with diagnosis and treatment.²

¹ "Surgical Anatomy", by G. Massie, M.B., M.S., F.R.C.S.; Third Edition; 1937. London: J. and A. Churchill Limited. Medium 8vo, pp. 478, with 153 illustrations, many of which are in colour. Price: 18s. net.

² "Diagnosis and Non-Operative Treatment of the Diseases of the Colon and Rectum", by G. Schwarz, M.D., J. Goldberger, M.D., and C. Crocker, M.D.; 1937. London: H. K. Lewis and Company Limited. Demy 8vo, pp. 552, with 246 illustrations and 9 coloured plates. Price: 40s. net.

The anatomy and physiology of the colon and rectum are first briefly considered and then the methods of examination are discussed in detail. A new method of proctosigmoidoscopy has been evolved by the authors in which an optical system is made use of as in a cystoscope, and this provides a larger and clearer field of vision with an instrument of smaller calibre than those usually employed. Inflation with air or fluids is possible and the apparatus is known as a "deplicoptic" proctosigmoidoscope. Detailed instructions for the use of the instrument and several excellent coloured plates are reproduced. Laboratory tests of the stools and the recognition of intestinal parasites are well discussed. The pyramidon test for occult blood is preferred to benzidine as being easier to perform and just as accurate and delicate in its results.

Probably the best chapters in the books are those devoted to methods of X ray examination in which numerous illustrative case histories with their X ray photographs are reproduced.

Barium meals, opaque enemata and fluoroscopy are described. Barium enemata are controlled by fluoroscopy by a technique which is outlined and called "irrigoscopy". The importance is emphasized of repeating the examinations after a few days if the results are not completely normal or are doubtful.

Forsell's work on the movements of the colon is described and the types of haustra and haustral movements of the colon are illustrated. Mass movements, "cradle" movements and retrograde movements are discussed. Typical X ray photographs of diseases and tumours of the colon are freely reproduced.

In the diagnosis of chronic appendicitis by X ray methods the authors are commendably cautious in their conclusions. General methods of treatment are described and detailed diet charts, prescriptions and formulæ for local applications are given. A Higginson's syringe is illustrated with a bone or vulcanite nozzle without a statement of the dangers of this appliance or the precautions to be followed with its use.

Treatment of the dysenteries and of diverticulitis and injection methods for piles, fissure-in-ano and *pruritus ani* are also outlined.

An excellent index and a comprehensive list of references to the works and original papers mentioned in the text add considerably to the usefulness of the book.

A BOOK ON TREATMENT.

PUBLICATIONS dealing essentially with treatment fall into two classes—books of instruction and works of reference. "Modern Treatment and Formulary", by Mullen,¹ is definitely of the latter type. Its effective use requires in the reader a thorough grounding in the subject under review; it can never displace standard works on treatment, but rather form a most valuable supplement to them. Thus, for instance, an article of three hundred words on treatment of rheumatoid arthritis cannot possibly be adequate. Again, the section on chronic nephritis, though detailing many useful measures for the relief of main symptoms, fails to produce a comprehensive picture of the patient himself. And thus it is throughout the work.

In short, the principal function with the book performs—and that most admirably—is to present in concise and handy form most of the recognized and effective measures available for the relief of symptoms. How to relieve an intestinal colic, or terminate a paroxysm of tachycardia, how to abate a persistent leucorrhœa, the most suitable treatment in the various phases of hæmorrhoids—these and hundreds of similar problems are dealt with in an efficient and lucid manner, and the author's statements are

supported by a generous array of pharmaceutical formulæ. The use of the book is made easy by the simplicity of its arrangement, together with a meticulous system of cross-reference.

The appendix introduces an excellent compilation of diet lists, which, read in conjunction with the text, will assist the physician to give clear and intelligible advice.

The section on differential diagnosis is very well presented. "Gout usually attacks the wealthy, rheumatism . . . the poor" is by no means a fair selection from the many excellent thumb-nail sketches of differential symptoms. There is also an outline of first-aid and emergency treatment, including a rather too condensed section on poisons and their antidotes. The "physician's interpreter, outlined in five languages, specially arranged for diagnosis" might be improved with a guide to pronunciation; but then, one can't have everything.

Properly regarded as a work of reference, this handy volume might well become one of the most used books on the doctor's shelves.

OTO-RHINO-LARYNGOLOGY.

"DISEASES OF THE NOSE, THROAT AND EAR", by I. Simpson Hall, is a commendable attempt by the Lecturer in Oto-Rhino-Laryngology of Edinburgh University to prepare a book of reasonable size on this subject for the use of students and the general practitioner.¹

The common fault in a work of this kind is that the author attempts to write something about every disease in the specialty under consideration. The book tends to become encyclopedic to the detriment of its utility, and the author, in an endeavour to reduce the number of pages, deals at insufficient length with many of the commoner problems, and gives sketchy outlines of many that might be omitted altogether. The result is that the practical value of the work is lost.

The common guillotine tonsillectomy and the operation for the removal of adenoids, procedures which almost every practitioner is called upon to undertake, are inadequately described and poorly illustrated in this, as in most of the smaller works. Yet there is a definite need for a practitioner's text-book in which these operations shall be fully set out and illustrated. Moreover, a careful description and illustration of the procedure for packing the nose in the production of local anaesthesia, of the steps necessary in the control of epistaxis before packing is finally resorted to, of the operation of *paracentesis tympani*, of the procedure in direct laryngoscopy, *et cetera* would be welcomed. At the same time, the descriptions of tonsil dissection, of submucous resection of the nasal septum, of mastoid surgery, of the radical operations on the nasal sinuses, and of the technique of insertion of the bronchoscope or the œsophagoscope could well be abbreviated. These radical procedures should be undertaken only by those who have had much experience and have fully studied the subject. Any abbreviated description of these procedures, however, should be so worded as to avoid giving the impression that they are easy and may be attempted by all.

The description of the routine methods of examination of the various regions of the ear, nose and throat is excellent. Likewise, the section on the examination and functional tests of the ear is very clearly set out. The author's style is most lucid and the book is easy to read; it leaves the impression that he is a sound teacher. On the other hand, a work of greater utility might have been produced if more time had been given to the choice of sections for full detail and if a large series of illustrations of the essential operations had been included.

¹ "Modern Treatment and Formulary", by E. A. Mullen, F.D., M.D., F.A.C.S., with foreword by H. C. Wood, junior; 1936. Philadelphia: F. A. Davis Company. Demy 8vo, pp. 707.

¹ "Diseases of the Nose, Throat and Ear: A Handbook for Students and Practitioners", by I. S. Hall, M.B., Ch.B., F.R.C.P.E., F.R.C.S.E.; 1937. Edinburgh: E. and S. Livingstone. Crown 8vo, pp. 438, with illustrations. Price: 10s. 6d. net.

The Medical Journal of Australia

SATURDAY, AUGUST 14, 1937.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction, are invited to seek the advice of the Editor.

GASTROSCOPY.

In a leading article on the subject of gastroscopy that appeared in *The Lancet* in February of this year it was stated that the procedure was still so new in English-speaking countries that those who wrote about it wrote as for the uninitiated. In France and Germany many text-books have been devoted to gastroscopy; but it must be owned that until quite recently the difficulty of constructing a reliable instrument had not been overcome, and previous disappointment probably caused many clinicians to doubt the truth of reported success. Very few medical practitioners in Australia can claim to have been initiated into the mysteries of the gastroscope; Dr. John Horan's article on the subject, published in this issue, will therefore be welcomed. Dr. Horan has recently studied in America with Rudolph Schindler, a worker who has probably done more than anyone else to make gastroscopy suitable for clinical use; and the coloured illustrations accompanying his article have been prepared in his clinic at Saint Vincent's

Hospital, Melbourne. We hope that his careful exposition of the subject will inspire readers with a desire to know more about a method of examination which is destined to be widely used in the future. Further enlightenment will be found in an article by Hermon Taylor, of the London Hospital, appearing in the January, 1937, issue of *The British Journal of Surgery*, a publication readily obtainable in Australia. At the same time we would recommend every specialist physician and surgeon to read a book recently published in Chicago by Rudolph Schindler.¹

Schindler's book covers the whole field of gastroscopy. After giving a preliminary history of the procedure he describes the anatomy of the pharynx, œsophagus and stomach. He then deals with the technical problems of gastroscopy and with its technique. He discusses the "orientation in the stomach" and describes the gastroscopic picture of the normal stomach. Successive chapters are then devoted to the appearances characteristic of various pathological conditions. Then follow most interesting chapters on the relationship between gastroscopy and surgery, gastro-photography and X ray appearances. Schindler is insistent, and his contention will readily be granted, that an efficient gastroscopist must be not only a well-trained gastroenterologist well versed in internal medicine, but also an expert technician and a psychologist. In his opinion the psychological problem is the more important, for, no matter how much skill is shown in other directions, an improper psychological approach to the patient will create difficulties that the best technician cannot overcome. "Merely owning a gastroscope does not make one a gastroscopist any more than the purchase of a scalpel qualifies one as a surgeon." Considerable experience will also be needed before an observer will be able to interpret what he sees with the aid of his instrument.

That in skilled hands the gastroscope will be of great use there is no doubt. Probably the most conservative clinicians will agree that early car-

¹ "Gastroscopy: The Endoscopic Study of Gastric Pathology", by Dr. R. Schindler, with a preface by Dr. Walter Palmer; 1937. Chicago: The University of Chicago Press. Crown 4to, pp. 357, with 89 text-figures and 96 colour reproductions of gastroscopic observations. Price: \$7.50 net.

cinoma of the stomach will be more easily diagnosed if a gastroscopic examination is made whenever there is the slightest uncertainty in the interpretation of symptoms of a patient of cancer age. Schindler is of the opinion that gastroscopy combined with the use of X rays can completely supplant exploratory laparotomy. If this is true, the use of the gastroscope should be taught in every large surgical centre. Schindler also holds that gastroscopy should be performed in every case in which a patient with gastric ulcer is to be treated by medical means; he points out that gastroscopy may prove the ulcer to be malignant and so prevent time being lost in attempts at medical treatment. It will, of course, be said that Schindler and others who are expert in the use of his instrument are enthusiasts and over-emphasize its usefulness. In reply it may be stated that conservatism upheld to the detriment of a patient's welfare and to the prevention of progress in medical science is bad.

Two statements remain to be made. The first is that quite possibly the gastroscope in the hands of skilled observers will throw some light on the inter-relationship of such conditions as cancer of the stomach, gastric ulcer and chronic gastritis, a condition which is receiving increasing attention. The second is that a protest should be made against the injury that this instrument will do to the English language. For years we have been told of patients who were "sigmoidoscoped" or "cystoscoped"; now we are told that people are to be "gastroscooped". No lover of the English tongue can tolerate such an atrocity.

Current Comment.

RECENT WORK ON SCARLET FEVER.

It is well recognized that in the hospital treatment of scarlet fever certain complications are likely to develop during convalescence. These vary from transient unexplained fever, acute tonsillitis, cervical adenitis, *otitis media* or nephritis to a return of the complete clinical picture of scarlet fever, the so-called relapse. Added to these, of course, are the occasional cross-infections by other infectious diseases, such as measles, diphtheria, pertussis and varicella. In recent years evidence has been accumulating which indicates that many

of these late complications of convalescence are caused by reinfection with a different strain of hæmolytic streptococcus derived from another patient. If this is so, then much of the illness is preventable. The incidence of these complications is considerable, as the following figures from an Australian hospital for infectious diseases indicate. One hundred and thirty children under the age of ten years suffering from scarlet fever were admitted to hospital between July 12 and September 4, 1936, and nursed in wards containing eight to twenty-five beds with the inadequate free space of only three to five feet between beds. Of these hundred and thirty patients, ninety-two suffered from complications, as follows: At the time of their admission to hospital sixteen patients were suffering from *otitis media*, two from nephritis, one from bronchopneumonia and one from diphtheria. Within ten days seven patients suffered from unexplained fever, seven from *otitis media*, four from adenitis, and one from varicella. After the tenth day thirty-nine had unexplained fever, nine were suffering from *otitis media*, four from arthritis, fourteen from adenitis, three from "rhinitis of convalescence", four from "tonsillitis of convalescence", twenty-five from varicella, five from diphtheria, and three from pertussis; one patient suffered a relapse.

The results of a particularly careful and systematic investigation of this question in London have recently been published by V. D. Allison and W. A. Brown.¹ These authors have studied the serological types of hæmolytic streptococcus (*Streptococcus pyogenes*) in swabs from the nose, throat and other lesions, if any, in patients suffering from scarlet fever. In a series of one hundred patients nursed in large wards they found at the time of discharge from hospital that 57 harboured a type serologically different from that present on the patient's admission, in 27 the type had not changed, in 13 the swabs were "negative" on the patient's discharge from hospital, and in three the type could not be identified. In a second series 16 patients were nursed separately in cubicles and swabs were taken twice a week, and from none of these patients was a streptococcus found different in type from that present when the patient was admitted to hospital. A milk-borne epidemic was also studied. Type I *Streptococcus pyogenes* was obtained from all of twenty-three patients examined and from one of the milkers and his family. Eight of the victims were nursed in one ward, which contained no other patients; their convalescence was uninterrupted, and Type I organism alone was isolated throughout the course of their illness.

The next opportunity for studying the question of reinfection occurred during an epidemic when a new ward of twenty-two beds was opened. This ward was within forty-eight hours filled with patients suffering from scarlet fever, and later new patients were admitted as vacancies occurred, so that during the 13 weeks the ward was in use 47 people were treated. These were investigated

¹ *Journal of Hygiene*, April, 1937.

twice a week by swabs of nose and throat and of any complicating inflammatory exudate, and at the same time, but independently, careful clinical records were kept of all interruptions of normal convalescence. At the end of the time the clinical and bacteriological findings were compared. Fourteen of the 47 patients showed no change in type, and of these one had albuminuria for a few days at the end of the first week, and another suffered from an external otitis at the end of the third week. The remaining 33 were found to have become infected with a different type of *Streptococcus pyogenes*, and of these, 18 developed complications, which varied from tachycardia for forty-eight hours, slight rise of temperature for twenty-four hours, to coryza, tonsillitis, cervical adenitis, *otitis media* and in two cases a second attack of typical scarlet fever. With one exception these complications coincided within seventy-two hours with the finding of a different serological type of hæmolytic streptococcus in each of the 18 patients concerned. The exception was a patient who manifested *otitis media* at the beginning of the second week of a Type I infection and from the end of the third week till the ninth week became successively reinfected with Types III, IV, V and II. The average time of persistence of the primary infecting strain was 2.6 weeks, of appearance of reinfecting strains in 33 patients 2.4 weeks, and of clinical signs in the 18 patients showing complications 2.6 weeks. Swabbings taken every week from the ward staff showed that seven out of ten harboured *Streptococcus pyogenes* on two or more occasions, three had "negative" swabs throughout, while three were persistent carriers; of these, two were reinfected, one without clinical signs, the other with an attack of acute tonsillitis.

Allison and Brown conclude that it is probably correct to say that reinfection is the cause of over 90% of the complications appearing during the third and subsequent weeks of hospitalization. They have no information on the relationship, if any, of reinfection to the occurrence of nephritis. These results, if confirmed, will have a profound effect on the hospital treatment of scarlet fever, for they indicate that patients suffering from this illness should not be placed together in large wards, but rather isolated during their entire illness in separate rooms or cubicles. Many patients so isolated could possibly be discharged with safety at a much earlier date than is at present the custom.

A further consequence of the work by Allison and Brown is that it casts doubt on the conclusions of Banks, who in 1936 published the results of administering scarlet fever antitoxin to a large series of patients with apparent reduction of fatality and morbidity rates as compared with controls to whom serum was not given.¹ However, the 2,428 patients treated with serum were kept in hospital for an average period of about eighteen days, whereas the 1,473 controls averaged approximately thirty-four days, and the difference observed may have been in part due to the difference in

period of hospitalization, in part to the effect of serum, and in part to the fact that the control group contained a greater proportion of patients with mild infections. Allison and Brown consider these mild cases more likely to show clinical signs of reinfection in convalescence because a "solid" immunity would probably not result from the original infection.

INDIAN INDIGENOUS GOLD PREPARATIONS.

THE indigenous drugs of India are being investigated in the departments of pharmacology and chemistry of the Calcutta School of Tropical Medicine. Many of these drugs have their origin in antiquity and have an interesting history. Although most have been evolved in empiricism, many have been shown by modern methods to be of value. Two gold preparations—*swarna bhasma* (reduced gold) and gold *kusth*—have recently been reported on by R. N. Chopra, Sudhamoy Ghosh and A. T. Dutt.¹ *Swarna bhasma* is prepared from gold leaf, which has to be subjected to a preliminary "purification" consisting of heating to redness and then steeping seven times in each of the following: oil, whey, cow's urine, *kanji* and extract of *Dolichos uniflorus*. There are several methods of preparing the *bhasma* from the gold leaf; but the basic principle is always the same: an intimate mixture with mercury, sulphur and citric acid, and repeated roastings. Be it noted that in one method the mass of gold, mercury and sulphur is roasted on thirty pieces of dried cowdung cakes. A sample of *swarna bhasma* obtained from an Ayurvedic factory at Calcutta consisted of a dull brown amorphous powder that glistened on being rubbed on a hard surface, and had the physical characteristics of gold. Analysis showed that the sample contained 96.76% of metallic gold and minute quantities of various other inorganic substances. A sample of gold *kusth*, a Mohammedan medicine, contained 86.14% of metallic gold. In both substances the gold was found to be in a state of fine subdivision. For internal administration the powder is rubbed with other substances (differing in different diseases) to form a paste. Chopra, Ghosh and Dutt suggest that by this treatment some of the insoluble powder is changed to a colloid, which may be absorbed in minute quantities. They also mention the possibility that the metallic gold combines with other substances in the intestinal tract, to form soluble compounds. In Hindu and Mohammedan medicine gold preparations are used in such conditions as neurasthenia, chronic fevers, tuberculosis, heart disease, anaemia, debility, dyspepsia, sexual impotence, excessive nocturnal emissions *et cetera*. The preciousness of gold seems to be responsible for much of the faith in its therapeutic potency. It has proved to be valuable in certain conditions; but in some in which it has been used a preparation of any other expensive substance dug from a mine would be as effective.

¹ *The Lancet*, September 5, 1936.

¹ *The Indian Journal of Medical Research*, April, 1937.

Abstracts from Current Medical Literature.

SURGERY.

The Treatment of Open Injuries.

MICHAEL L. MASON (*The Western Journal of Surgery, Obstetrics and Gynecology*, May, 1937) outlines some of the principles involved in the treatment of open injuries. In all open injuries the logical goal is the removal of foreign substances accidentally introduced into the wound and the closure of the wound. The removal of foreign bodies was practised by the Egyptians and taught extensively by the Greeks; the work of Lister simply extended the ancient practice. Paracelsus in 1536 propagated the doctrine that the surgery of wounds consisted chiefly in preventing interference with healing and allowing Nature to proceed unchecked in her operations. In modern days there has been too great a tendency to deal with the extermination of organisms and to neglect Nature's processes of healing. It is generally admitted that every injury should be treated as soon after its infliction as possible. Rest must be provided and the process of repair stimulated by the removal of irritant materials, whether bacterial, chemical or mechanical. All wounds should receive attention within the first six hours of infliction; by this time wounds are contaminated but not infected, unless such infection is caused by organisms already accustomed to animal tissues and fluids. Shock and hemorrhage must be given attention. Further trauma must be avoided. Fortunately, the use of damaging cauterizing agents has almost entirely disappeared. Clamping and rough retraction are to be deprecated. Rest is one of the greatest factors favouring the natural process of wound repair. Immobilization of the injured part may be the most valuable single procedure. If care is needed to prevent infection of clean wounds, much more care should be exercised lest already infected wounds receive a multiplicity of organismal infections. Brilliant antiseptics may merely cover up the dirt. Meleney has shown that under the usual operating conditions one to two bacteria per minute fall on an open Petri dish, and he has estimated that during an hour of operating approximately 50,000 bacteria lodge within the sterile field of which the open wound forms a part. Experience may be the only guide to estimating the vitality of reflected skin flaps or damaged muscle elements.

Fat Embolism.

A. J. WATSON (*The British Journal of Surgery*, April, 1937) reports a case of fat embolism and reviews the literature dealing with the subject. The patient was a male, aged twenty-

two years, who sustained a fracture of the right tibia. On admission to hospital the patient was considerably shocked. The fracture was compound and reduction was delayed for several hours until the condition of shock had improved. Under ether anaesthesia the wound was cleaned and reduction was effected, retention being secured by means of a plaster casing. Twenty-four hours after operation the patient complained of precordial pain. The temperature and pulse rate had risen. Respirations were rapid and a cough was present. Twelve hours later the patient became unconscious and the temperature reached 102° F. The coma became progressively deeper, and death occurred approximately eighty hours after admission to hospital. Prior to death petechial skin hemorrhages appeared and fat embolism was suspected. *Post mortem* minute hemorrhages were found scattered throughout the white matter of the brain, but no cerebral laceration was found. Microscopic examination of sections of the various organs revealed fat emboli. The author's conclusions on the pathogenesis of the condition were recorded in *THE MEDICAL JOURNAL OF AUSTRALIA* of July 24, 1937, at page 148.

Pitressin.

L. SEED, F. H. FALLS AND B. FANTUS (*Surgery, Gynecology and Obstetrics*, May, 1937) have studied the action of pitressin (β -hypophamine) on the human bowel. They conclude that it produces powerful colonic contractions, but that its routine use before and after laparotomy in a well-controlled series of cases was not notably beneficial. In simple post-operative atony a small dose, such as 10 or 20 units, combined with the use of a rectal tube, was found to flatten the abdomen quickly; when a few such injections fail to produce results it may be concluded that the distension is probably due to either peritonitis or obstruction, and in these latter circumstances, if one does not persist in the use of pitressin it is considered doubtful that any harm can result. The authors conclude that its administration after the onset of peritonitis did not influence the outcome for better or for worse. The secondary effects of pitressin on the vascular and urinary symptoms were found to be relatively unimportant in ordinary therapeutic doses; its intravenous use would be inadvisable.

Carcinoma of the Colon.

W. F. GEMMILL (*Surgery, Gynecology and Obstetrics*, April, 1937) reports a study of thirty-eight cases of carcinoma of the colon. The author states that the majority of patients with growths originating in the colon are treated in local hospitals and do not reach the great medical centres; operative procedures therefore are often of an emergency character, the patients do not receive adequate preparation and the appropriate surgical procedure is not properly

planned. For nearly a century a familial tendency to polyposis of the colon has been recognized, and since malignant change occurs in 40% of cases of polyposis, the multiple character of carcinomata in the colon is readily understood. Chemical and physical traumata alter the clinical picture produced by this condition. When carcinoma is situated in the caecum one of the anemias may be simulated, whilst its presence in the sigmoid frequently produces obstruction. There is no common symptom. In fact, less than 10% of patients have symptoms usually classed as "characteristic". However, a number of patients have been observed to complain of the passage of mucus. The author believes that the diagnosis of ulcerative colitis is made all too frequently. It is common knowledge that pain is seldom present until the disease has reached an advanced stage. Treatment by X rays is as a rule inadvisable. In untreated cases the causes of death are obstruction, perforation or peritonitis, and the mortality without treatment is 100%. Nearly all the patients admitted to hospital need the correction of water and chemical balance, and the pre-operative treatment is second in importance only to the operation itself. Dextrose in salt solution should always be given prior to operation, and the "poorer risk" patients must receive blood transfusions. In all cases decompression of the bowels must be carried out. The author believes that whenever possible a two- or three-stage operation of the Mikulicz type should be carried out. Radium has proved useless in most of these conditions. In the author's series approximately 40% of patients were admitted to hospital suffering from an obstruction of the bowel.

Internal Derangement of the Temporomandibular Joint.

T. F. MULLEN (*Western Journal of Surgery, Obstetrics and Gynecology*, April, 1937) describes some internal derangements of the temporomandibular joint, which are essentially due to an alteration in the relations of the meniscus and the articular surfaces as the joint motions are carried out, and which are occasioned by trauma or continued strain on one or the other joint, or dysfunction of the external pterygoid muscles. To this is added eventually an inflammatory change in the joint structures, causing the symptoms characteristic of arthritis—pain and stiffness and reflex spasm of the muscles moving the joint. Further progress leads to relaxation of the capsule and ligaments, with liability to dislocation of the meniscus with secondary changes, such as thickening, erosion or fragmentation. As a result of this, locking of the joint may occur in either the closed or open position, due to mechanical blocking. Conservative treatment, rest and antiphlogistic measures frequently result in relief, which may not be permanent, and

should be accompanied by dental treatment to correct any abnormality of occlusion. The principles of joint surgery are applicable to this joint, and it should be explored when the condition is progressive, when it fails to yield to conservative measures, or when there is evidence of dislocation or fracture of the meniscus. Surgical relief may be obtained by measures which limit the excursions of the joint, or by an attack on the meniscus itself, which may be fixed or removed in part or in whole. The exposure is discussed.

Chemical Factors in Experimental High Intestinal Obstruction.

E. C. CUTLER AND M. PIJOAN (*Surgery, Gynecology and Obstetrics*, May, 1937) record the results of a study of certain chemical factors in experimental high intestinal obstruction in dogs. They found a delayed absorption of material from the duodenum, especially of dextrose and of saline solution. It appeared that the liver and pancreatic juices played an important rôle in the absorption of saline solution and dextrose from the intestines. In these cases there was an increase in the blood potassium following high obstruction, and this was thought to have been a contributory factor in the cause of death. The increase in the non-protein nitrogen and the progressive alkalosis noted by previous observers were also confirmed.

Severe and Fatal Reactions following the Intravenous Use of Gum Acacia-Glucose Infusions.

WILLIAM E. STUDDIFORD (*Surgery, Gynecology and Obstetrics*, April, 1937) describes certain severe and fatal reactions following the intravenous use of gum acacia-glucose infusions. Czerny first injected colloid solutions intravenously in animals in 1894. Bayliss popularized the procedure during the War, when gum acacia solutions were used for the treatment of shock or hemorrhage. Bayliss continued his experimental work on gum solutions, and in 1922 advocated the avoidance of excessive heat in their preparation. Up till 1933 favourable results were reported after the intravenous injection of gum acacia solution in many thousands of cases. In the last four years a number of observers have reported unfavourably upon the results of similar injections. In 1935 three surgeons reported the deaths of children in all of whom tender enlarged livers were present prior to death. During the years 1934 and 1935 a great many obstetric patients were given a solution containing 6% of gum acacia and 20% of glucose at the Bellevue Hospital, New York. Early in 1936 similar solutions were administered, and on two consecutive days deaths occurred. The symptoms in each were those of an acute cardiac failure. Nearly 50% of the ampoules administered to patients gave rise to severe toxic reactions, and the remainder of the batch was

submitted to chemical analysis. However, no fault could be found with the solutions. In the fatal cases autopsy revealed an excessive accumulation of glucose and of acacia in the liver. Transient attacks of cyanosis and dyspnea have been noted in many patients receiving gum acacia-glucose solution intravenously during the past two or three years. The question arose as to whether the hepatic capillaries were plugged by the gum acacia. Further work is being carried out by the author on this problem. In the fatal cases a condition resembling acute yellow atrophy of the liver has been observed. There is also some evidence that acacia causes interference with the normal gaseous interchange of the blood cells and plasma. The author concludes that hemorrhage or shock may be treated more safely by the use of simple solution or glucose infusions than by the combination of gum acacia and glucose.

Acute Pancreatic Necrosis.

C. E. HAGYARD (*Western Journal of Surgery, Obstetrics and Gynecology*, May, 1937) outlines the history of acute pancreatic necrosis. The condition was identified by Rokitsansky in 1863, but very little progress has been made in its identification or treatment. Quick, of Melbourne, believes that it is responsible for a large number of sudden deaths formerly attributed to acute indigestion or heart disease. Pancreatic necrosis was produced experimentally by Claude Bernard in 1856. Since then it has been found possible to reproduce the condition by the injection of a number of foreign substances into the pancreatic duct. Before bile can enter the pancreatic duct to any great degree an obstruction must be present in the vicinity of the sphincter of Oddi. Morphine is known to increase the spasm of this sphincter, when a dose of one one-hundredth of a grain of glyceryl trinitrate under the tongue gives immediate relief. Pancreatic necrosis is usually secondary to diseases of the biliary tract, but tendency to necrosis is exaggerated by excessive functional activity of the gland, so that large eaters are more prone to suffer from the disease. A hemorrhage which accompanies the onset of the disease is due to the action of trypsin on the walls of both arteries and veins. The clinical diagnosis of the condition is always difficult, even in the chief surgical centres, but positive diagnosis is made in less than 30% of cases. Moynihan stated that no other catastrophe within the abdomen produced at once such unendurable agony and so profound a collapse. Hypoglycemia associated with a high blood diastase has been considered characteristic of pancreatic necrosis. The higher the blood and urinary diastase are found to be, the more likely is the condition to be that of pancreatic necrosis. In considering treatment, prophylaxis is important. Chronic disease of the biliary tract should receive early

treatment. Obesity and over-eating should receive attention. The disease almost entirely disappeared from Germany during the lean years of the War. When diagnosis is doubtful, operation must be resorted to without delay. Drainage of the biliary tract has given relief in many fulminating cases. For the relief of pain "Evipan sodium" or "Nembutal" is indicated.

Urological Complications of Cancer of the Rectum.

J. D. BARNEY AND S. B. KELLEY (*New England Journal of Medicine*, May, 1937) review a series of 200 cases of carcinoma of the rectum from the Massachusetts General Hospital, and conclude that urinary complications occur in about 60% of cases and are often incapacitating. They were found to be absent in at least half of the patients with bladder and prostatic involvement. They occurred for the most part after the two-stage or the combined abdomino-perineal operation, and varied considerably in the practice of different surgeons. While pre-operative symptoms occurred in 38% of the cases, they were largely those of infection. Damage to the presacral nerve was considered an improbable factor in the production of urinary complications.

Acute Perforated Peptic Ulcer.

H. P. TOTEN (*Western Journal of Surgery, Obstetrics and Gynecology*, April, 1937) details his technique for the treatment of the acute perforated peptic ulcer. The most desirable method is simple suture, but when this appears inadvisable and the ulcer is near the pylorus, the author advises a pyloroplasty which does not involve duodenal mobilization. He describes this operation. Thorough aspiration of the peritoneal cavity with suprapubic drainage of the pelvis is considered to be an essential part of the operative procedure. Post-operatively the use of the indwelling Levine tube and adequate amounts of intravenous glucose in salt solution are used.

Congenital Dislocations of the Hip.

PAUL C. COLONNA (*Surgery, Gynecology and Obstetrics*, December, 1936) thinks that the treatment of congenital dislocation of the hip in the majority of the patients over three years of age is best accomplished by some form of open operation. He has adopted a two-stage procedure. The first stage consists of a thorough stretching of the muscles about the hip, subcutaneous tenotomy of the adductors and skin or skeletal traction preliminary to open operation. At the second stage the arthroplasty is performed after separation of the great trochanter with its attached pelvi-trochanteric muscles, and preservation of the synovial membrane line capsule covering the head of the femur, which is placed deeply within the reamed-out acetabulum. An excellent range of movement has in general been obtained in patients up to the age of eight years.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Victorian Branch of the British Medical Association was held at the Medical Society Hall, East Melbourne, on February 3, 1937, PROFESSOR R. MARSHALL ALLAN, the President, in the chair.

Carbohydrate Metabolism in Celiac Disease and Abdominal Tuberculosis.

DR. C. WALLACE ROSS read a paper on carbohydrate metabolism in celiac disease and abdominal tuberculosis. He explained that his paper was a summary of work carried out by him overseas under a grant from the Medical Research Council. The results of the work had previously been recorded in the *Transactions of the Royal Society of Tropical Medicine and Hygiene* of June, 1936, and in *Archives of Disease in Childhood* of August, 1936.

Dr. Ross began by summarizing some of the more recent work on normal carbohydrate metabolism, particularly with regard to glucose tolerance and the mode of action of insulin. He said that glucose tolerance had been the subject of a vast amount of work in the sixty years which had elapsed since the publication of Claude Bernard's great work, "*Leçons sur la diabète et la glycogénèse animale*". In the earlier part of that period many experiments were made, beginning with those of Worm Muller in 1884, to find a measure of the normal power to assimilate sugar. Work along these lines, in which many different types of experiment were used, had led gradually to the form of glucose tolerance test which was now associated with the name of MacLean.

As by-products of this work, however, several striking facts had been established which could not at the time be readily explained: (i) Claude Bernard had recognized the occurrence of glycosuria when large amounts of sugar were fed to starving animals, a phenomenon which Hofmeister (1889) again observed and named "hunger diabetes". (ii) Johansson (1909) had made the first observations upon the respiratory quotient of men who had fasted for one and a half to three days and were then given large doses of sugar. He found that there was no rise in the output of carbon dioxide. Similarly, F. G. Benedict's famous "subject L", who broke a thirty-one-day fast with a diet high in carbohydrate, showed a respiratory quotient of 0.8 in 36 hours and 0.97 in 60 hours after breaking his fast. (iii) Bang (1913) had shown that the glucose tolerance of a normal person was impaired by fasting—an observation since confirmed beyond question. (iv) Hamman and Hirschman (1919) had shown that if two glucose tolerance tests were done on the same patient at a short interval, the second always gave a lower and shorter curve than the first. (This phenomenon was unfortunately known as the Staub-Traugott phenomenon, though this work came later.) This discovery, along with that of Bang, had been amplified by du Vigneard and Karr (1925), who showed that an increased proportion of carbohydrate in the diet led to an increased tolerance for glucose given either orally or intravenously, and by Sweeney (1927), who showed the effect of carbohydrate upon glucose tolerance and was able to establish typical normal glucose tolerance curves for certain diets.

Dr. Ross said that this group of observations could be summarized in the statement that carbohydrate starvation led to an impaired tolerance for glucose, with the result that when sugar was given after a period of starvation, the blood sugar level rose to abnormal heights, possibly with glycosuria, and the respiratory quotient did not immediately rise. Overfeeding with carbohydrate, on the other hand, led to a precisely opposite condition.

The introduction of insulin in 1922 had given a fresh stimulus to work on carbohydrate metabolism, and in particular many experiments had been undertaken in the succeeding years to find what might be termed the "glucose-equivalent" of insulin—how much insulin could

react with or metabolize a given amount of sugar. It had soon emerged, not only that no such fixed equivalence existed, but also that a similar series of phenomena to those just described in relation to tolerance called for explanation. Abderhalden and Wertheimer (1924) had shown that a given dosage of insulin produced a greater depression of blood sugar level in fed than in starved animals.

Staub (1926) had shown that the insulin-sensitive property of a carbohydrate-fed animal could be transferred to a starved animal by transfusion of blood from the one to the other. Dann and Chambers (1930) had found that the glycosuria which resulted from feeding sugar to starving dogs (hunger diabetes) could not be controlled by giving insulin.

This second group of observations might be taken to mean that the sensitivity of the organism to introduced insulin was increased when the subject had had abundant carbohydrate, because of the presence of some property, transferable in transfused blood, and conversely that carbohydrate deprivation implied shortage or absence of this property, with resultant insensitivity to insulin.

Meanwhile, from clinical and pathological sources there came still another group of facts: (i) Some diabetics proved resistant to treatment by insulin, requiring dosages far in excess of what was believed to be about the normal daily pancreatic output of about 80 to 100 units. In such cases some evidence of liver damage was usually found at *post mortem* examination. (ii) Insulin resistance was commoner among the small group of diabetics whose condition was due to haemochromatosis than in the general series. (iii) Any gross degree of liver damage led to an impairment of glucose tolerance.

With these three groups of facts as a foundation there had rapidly grown, largely to the credit of Himsworth, the view that there was a third factor in the insulin-glucose reaction, which he termed "insulin-kinase". If it was taken as a working hypothesis that such a body was normally produced, for the most part in the liver, in response to the entry of sugar into the portal blood stream, and that it had the property of activating insulin, whether endogenous or injected, then it would be clear that all of the observed phenomena previously enumerated could be explained. In fact, with the aid of this conception, and of a great deal of careful confirmatory work, it had become possible to state the present position of thought in this connexion in the form of three simple axioms: (i) The tolerance of an individual for glucose was directly proportional to the sensitivity to injected insulin. The relation of the two properties was in fact a linear one, and glucose tolerance might be regarded as sensitivity to the endogenous insulin. (ii) Insulin sensitivity was due to the presence in the body of a third factor in the glucose-insulin reaction, now usually referred to as "insulin-kinase". (iii) The degree of insulin sensitivity, and hence the glucose tolerance, of a healthy individual was determined solely by the amount of carbohydrate the diet had contained for the period preceding the test.

Dr. Ross examined these axioms in relation to the curves obtained from a normal subject.

Dr. Ross then discussed the special problem of celiac disease. He pointed out that the idea that the absorption of carbohydrate was deficient in this condition was no new one. He gave some details of work that had been done, and pointed out that the various views put forward included the possibilities of an absorptive defect or an endocrine disorder. MacLean and Sullivan had carefully excluded the possibility of a lowered renal threshold.

It had seemed to Dr. Ross that, with the aid of the three axioms, decisive evidence might be sought as to the presence or absence of an absorptive defect. The principle underlying his investigation was as follows. In the normal subject carbohydrate privation led to impaired glucose tolerance, shown by a high and rather slowly falling blood sugar curve following the administration of glucose, whether by the alimentary tract or intravenously; carbohydrate excess, on the other hand, led to an opposite condition of improved tolerance, with a low curve in both cases. In the presence of any disease process such as

would hinder or prevent the absorption of glucose from the gut, a different state of affairs would be expected, for the curve following oral administration should be of the flat type from failure of sugar to reach the blood, while the curve following intravenous administration should be high, as a result of the same tolerance as would follow carbohydrate deprivation in a normal person. Accordingly he had decided to compare the curves following oral and intravenous administration of glucose in a group of cases. The result had been striking, for the curves after intravenous administration had been as consistently high, in other words indicative of impaired tolerance, as the curves after oral administration had been flat. Dr. Ross at this stage showed curves indicating the mean elevation of the blood sugar above fasting level in ten well-marked cases of celiac disease and in four normal children of similar age. Not only was there a sharp contrast between these means, but in the twenty- to forty-minute period there was no overlapping of the curves in the two series of cases. This result seemed to offer strong evidence for the existence of an absorptive defect.

Further, if this was so, and if deprivation of carbohydrate by failure of absorption was the sole reason for the impairment of tolerance observed when a test dose of glucose was given intravenously, then the tolerance should be restored towards normal by supplying the body with glucose by the intravenous route over a suitable period of time.

Opportunity to demonstrate this change had been afforded to Dr. Ross in the case of a little girl, aged twenty-two months, whose history Dr. Ross told in detail. The history was typical of celiac disease. A tolerance test after the oral administration of glucose at this time gave the following result:

	Fasting	10	20	40	60	90	120 mins.
Mgm. %	54	84	96	90	78	72	61

A tolerance test after the intravenous administration of glucose showed a type of high curve usually found in severe celiac disease:

	Before Injection.	2	4	6	8	10	15	20	30	40	60 mins.
Mgm. %	52	235	276	249	235	216	242	258	223	153	106

Having improved considerably, the child was discharged in seventeen days to be treated at home. This was not successful, and six weeks later she had been readmitted to hospital in a very poor condition, having severe diarrhoea. Treatment along the usual lines was followed for some ten days. By this time dietary measures had controlled the diarrhoea, but the child was desperately weak and vomiting once or twice a day. In the belief, founded partly on the child's previous low fasting blood sugar levels, that hypoglycemia was the cause of much of the trouble, continuous intravenous treatment with glucose solution had been decided upon. This was initiated by a tolerance test, in which glucose was given intravenously, at the conclusion of which 63 grammes of glucose were run in over 43 hours, in the form of a 10% solution in normal saline solution. The clinical result of the treatment was a dramatic improvement, which had probably been due partly to a blood transfusion which immediately followed. Five weeks later a similar emergency arose, and the same line of treatment had been adopted. The tests done on this occasion showed almost identical results, and the clinical improvement had again been most gratifying. Dr. Ross showed slides of the curves plotted after the tests made throughout the child's illness.

Dr. Ross said that he had demonstrated firstly the association of high tolerance curves after the intravenous injection of glucose with the flat curves after oral administration; these were generally recognized. Secondly, he had shown the possibility of bringing these high curves towards a normal level by giving glucose intravenously over a period of time.

He then discussed the confirmatory evidence to be derived from the study of the insulin depression curves. He said that he was greatly indebted to Dr. A. V. Neale,

of Birmingham, for permission to use a large number of his results.

Badenoch and Morris (1936) had published results showing, in their own words, that "children with celiac disease are more sensitive to the effect of insulin than are non-celiac patients, as shown by the greater percentage reduction of blood sugar in the former after injection of insulin". With this conclusion Dr. Ross was quite unable to agree, the whole of his observations going to show the reverse. He showed curves obtained in Dr. Neale's cases after the injection of insulin and explained them in detail. He said that the discrepancy between these results and those of Badenoch and Morris had been discussed elsewhere. He added that it would suffice to say that he did not think the subcutaneous method of giving insulin a satisfactory one for this purpose.

Dr. Ross then discussed abdominal tuberculosis. He said that it had long been taught by eminent clinicians, notably the late John Thomson, that patients suffering from abdominal tuberculosis, especially where there was much diarrhoea or loss of weight, did best on a diet containing a liberal allowance of protein with some restriction of carbohydrate. The obvious suggestion was that there might be a defective power to absorb carbohydrate from the bowel, comparable with that in celiac disease, just as in some of these cases there might be a relative inability to absorb fat. Here again this idea was already supported by the finding of flat tolerance curves in many cases after the oral administration of glucose.

Ten patients had been examined in the same manner as those suffering from celiac disease. In all ten the curves after the oral administration of glucose were of a fairly flat type, the fasting level in two of the patients being notably low. The rises from the fasting level to the peaks of the curves were strikingly low in only a few cases and might alone have escaped comment. The curves, however, after intravenous administration of glucose were all of a high type, indicating gross impairment of tolerance. Here again was the apparent anomaly of curves after oral administration tending to be flat, with curves of the opposite form after intravenous administration. The explanation offered in celiac disease seemed reasonable here also. All of these cases had been of the glandular type, with easily palpable abdominal glandular masses, X ray evidence of calcification being present in several instances. Opportunity had later offered of studying similarly a case of abdominal tuberculosis characterized by ascites, in which no gross glandular involvement was discovered, and in which there had been no diarrhoea, though wasting was gross. The result here was very different, the curves being in all respects comparable with those of a normal patient on a very low carbohydrate diet—the curves after both oral and intravenous administration were high, leading to the inference that there was little or no absorptive defect. What then, was the cause of the impaired tolerance? Here Dr. Ross was disposed to tread dangerous ground and to suggest that the causal agent was the tuberculous toxemia. Evidence that this was considerable included a fairly high temperature and rapid pulse rate.

The last part of Dr. Ross's paper was devoted to a consideration of the effects of liver extracts. He referred briefly to his reasons for believing that insulin was normally activated by a kinase produced, for the most part, in the liver. Pursuing this belief into practical experiment, he had tried to ascertain the effect of an injectable extract of liver upon impaired tolerance. "Campolon" had been selected as being likely to contain any such principle as kinase, since it was prepared by simple expression methods without chemical alteration. Its intravenous injection was not advised by its makers, but the only untoward effect resembled a mild histamine reaction, the injection being immediately followed by a peripheral flush with a sense of great heat and some pulse acceleration, the whole passing off in about two minutes.

A number of patients had been subjected to this experiment, not all suffering from celiac disease, but all showing impaired glucose tolerance. The causal conditions fell into two groups—those in which the impairment was mainly due to deficient absorption, namely celiac disease,

the closely related "chronic intestinal indigestion without steatorrhea", and abdominal glandular tuberculosis on the one hand, and on the other disease of the liver itself, which had long been known to produce impairment of tolerance.

The mode of procedure was to give two cubic centimetres of "Campolon" in twenty cubic centimetres of normal saline solution into a vein from four to six minutes before carrying out the ordinary tolerance test. In a number of cases further examinations were made after prolonged treatment with liquid extract of liver by mouth, usually half an ounce twice a day, which was found to produce a similar effect.

Dr. Ross related in detail several cases in which this investigation had been carried out. The patients discussed by him had suffered from abdominal glandular tuberculosis, chronic intestinal indigestion, and coeliac disease. His general conclusion was that liver extracts contain a factor, possibly identical with "insulin-kinase", capable of improving the glucose tolerance and the sensitivity to insulin when these are impaired either by the carbohydrate deprivation consequent upon defective absorption, by intrinsic liver disease, or by the toxæmia of ascitic tuberculosis of the abdomen, sometimes to the great clinical benefit of the patient. Dr. Ross said that this factor did not seem to be identical with Castle's factor.

Dr. IVAN MAXWELL opened the discussion by congratulating Dr. Wallace Ross on the excellence of the research, a summary of which had been presented to the meeting. He said that only those who were in touch with laboratory work could fully appreciate the amount of work represented by such a contribution as that to which they had just listened. Dr. Ross had spent considerable time in adducing evidence in favour of the view that there was impaired absorption of glucose in coeliac disease and abdominal tuberculosis. The first evidence given was that after the oral administration of glucose in coeliac disease the blood glucose curve was much flatter than normal.

With regard to the blood sugar curve (glucose tolerance test), Dr. Maxwell pointed out that at least six factors were involved in determining the level of the glucose percentage in the blood. The first of these was the rate of emptying of the stomach. It was well known that a strong glucose solution was retained for a long time in the stomach, whilst fluid was added to it as gastric secretion until a hypertonic solution was made isotonic with the blood, before it was allowed into the small intestine. Dr. Ross had assured them that the emptying time of the stomach in cases of coeliac disease was normal, so that delayed emptying of the stomach was not responsible for the flattening of the blood sugar curve. The second factor involved was the rate of passage of material through the small intestine. Dr. Maxwell said that obviously if the glucose was very rapidly passed through the small intestine it might not be completely absorbed and thus flattening of the curve might occur. In this connexion it must be remembered that once the glucose had reached the large intestine it was not absorbed. Dr. Corkill, of the Baker Institute, had recently confirmed that point of view in a piece of valuable research. Dr. Ross had taken the precaution of testing the glucose tolerance in his patients when diarrhoea was at a minimum, and thus had largely eliminated that factor. The third factor was fermentation of glucose in the small intestine. This was another possibility, but probably the sugar was not a sufficient time in the ileum for it to be of much importance. Absorption through the wall of the small intestine was the fourth consideration. Despite the fact that the glucose molecule was comparatively small, it was quite conceivable that its absorption might be impaired by pathological changes in the intestinal wall. In the case of the kidney, such an extremely diffusible molecule as urea may find difficulty in passing through the glomerular membrane in certain forms of nephritis. Hence there was no difficulty in visualizing impairment of absorption through the intestinal wall as the result of pathological changes in its structure. Dr. Maxwell said that the fifth factor involved

in the regulation of the glucose curve in the blood was the rate at which glucose was removed from the blood by synthesis to glycogen or oxidation to carbon dioxide and water. Insulin was of great importance in this respect. Lastly, the renal threshold for glucose must be considered. If this was lowered, then much glucose would be lost in the urine and the blood curve would tend to be flatter. The work of earlier investigators indicated that the renal threshold for glucose was normal in coeliac disease.

Dr. Maxwell said that Dr. Ross had utilized in an ingenious way the observation of Himsworth that a high carbohydrate diet lowered and a low carbohydrate diet raised the glucose tolerance curve. He had shown that intravenous injection of glucose gave a higher blood sugar curve in patients suffering from coeliac disease than in normal persons, which indicated that the tissues of the body were suffering from relative carbohydrate starvation due to impaired absorption of carbohydrate from the alimentary tract. Dr. Maxwell said that a criticism of these blood sugar curves was that the rise in the blood sugar for the first ten minutes after the injection of glucose was well above the renal threshold for glucose, and hence a considerable quantity would no doubt be lost in the urine. This would modify the blood sugar curve. It seemed desirable that a quantitative estimation of this glucose loss should be made in each case. Dr. Maxwell suggested that a more accurate control should be used for estimating the effect of liver extracts on carbohydrate metabolism. He indicated that such control should consist of normal persons partaking of a low carbohydrate diet for some time. Blood sugar curves should then be determined (no doubt they would be high) and then liver extract should be administered for the desired period and the blood sugar curve estimated once more. In conclusion, Dr. Maxwell again thanked Dr. Wallace Ross for so aptly presenting this interesting subject to the meeting.

Dr. IAN WOOD, after thanking Dr. Wallace Ross, stated that in the examination of a series of sick children one must be impressed by the number of patients suffering from vague indigestion of obscure aetiology, who are treated empirically and not by methods which have a physiological basis. Though these complaints seriously affected the children, the underlying abnormal metabolism was not understood. Such a well-organized attempt to lighten the darkness as that made by Dr. Ross, who had chosen to discuss that night the more clinical side of his work on carbohydrate metabolism, was welcomed.

Dr. Wood drew attention to the frequency with which the effects of an excessive carbohydrate diet brought children under the care of a doctor. The commonest syndrome was the result of excessive consumption of starchy foods combined with an insufficient amount of protein. Dr. Ross had said that such a diet led to an increased carbohydrate tolerance. After the carbohydrate meal the blood sugar rose and then fell rapidly, perhaps below normal; indeed, a state of hypoglycæmia might appear, with the usual symptoms of irritability, tremor, weakness and even collapse. Dr. Ian Wood, on clinical grounds, had formed the opinion that these children suffered from a deficiency of protein rather than from an excess of carbohydrate; the appetite frequently fell to a very low level, and even if the carbohydrate content of the food was unchanged, the children's condition improved on the addition of liberal quantities of protein to the diet.

Dr. Wood had been very interested to hear Dr. Ross stress the importance of diminished carbohydrate absorption and the beneficial results obtained by means of intravenous therapy. Probably there were many conditions which retarded the absorption of carbohydrates; some of these conditions were recognized by physiologists, but this knowledge was not yet applied generally by clinicians. Dr. Wood deprecated the use of the term "toxic" to cover conditions which were really due to biochemical disturbances and which could be cured by appropriate treatment, which was often simple. As an example, Dr. Wood pointed out that Dr. Ross had drawn attention to the biochemical disorders which could be caused by abdominal tuberculosis. It had been customary up to the present time to accept the

signs and symptoms of the disease as being due entirely to the effect on all the organs of the body of the liberation of tuberculous toxins; but Dr. Ross had shown that there was impaired absorption from the bowel because of a mechanical block, and had explained the beneficial effects of intravenous therapy. It was interesting to study the development of the application of biochemical knowledge in the treatment of babies at the Children's Hospital, Melbourne. For many years the "toxæmia" produced by the dysentery organism had presented a problem. At one stage it was suggested that the large amount of fluid lost *per rectum* played a part in the production of the clinical picture, and boiled water was given freely between feedings; then it was considered that a state of acidosis existed, and baking soda was added to the boiled water. Then the historic researches of Sir Leonard Rogers and others in India drew attention to the importance of the loss of sodium chloride in the liquid stools of dysentery, and saline drinks were given to the babies. At the present time glucose-saline drinks were considered best. Moreover, in the case of these babies it was found that because of the rushed intestinal movement and the poor circulation there was impairment of absorption from the bowel; to combat this, fluids were injected subcutaneously and intraperitoneally. Finally, the technical difficulties of intravenous therapy had been mastered and, when their use was indicated, fluids were introduced directly into the blood stream. This procedure demanded a high grade of chemical purity of the ingredients; impurities caused undesirable reactions, such as rigors, hyperpyrexia and collapse. The continuous intravenous drip method of administration of fluids was a powerful weapon, which made it possible to introduce a large volume of fluid at a very slow rate. The body was thus enabled to adapt itself to the changing conditions. The whole problem of blood chemistry was opened up when were considered the nature and amounts of the substances which could with benefit be introduced into the blood in this manner. In view of the knowledge that the body would not tolerate much deviation from the normal arrangement of the constituents of the blood stream, it could be appreciated how very important it was that the methods of rectifying these fine biochemical upsets should be learned with certainty and exactitude.

In conclusion, Dr. Wood expressed his sympathy for Dr. Ross on account of the inherent difficulty of assessing the results of treatment when he was dealing with such diseases as celiac disease and abdominal tuberculosis, which had a tendency to wax and to wane and even to disappear spontaneously. It was not possible to dogmatize until many patients had been very closely observed; and Dr. Ross deserved much gratitude for the critical manner in which he was testing the validity of his theories, by carefully planned biochemical investigations combined with precise clinical observations.

PROFESSOR R. MARSHALL ALLAN, on behalf of the Branch, congratulated Dr. Ross on the high standard of the work he had done with his fellow workers in Birmingham, and on the excellent manner in which he had presented the subject matter of his address that night, and wished him further success on his return to England to continue the work.

Dr. Wallace Ross, in reply, said that he appreciated the encouragement which he had received. One of the difficulties he had encountered was the amount of persuasion that had been necessary to make the patients continue with the low carbohydrate diet for the period necessary for the completion of his observations. He was grateful to Dr. Maxwell for his remarks and kindly criticism, which would be borne in mind when he was planning the extension of the work; and to Dr. Ian Wood, who had dealt with some of the problems of high carbohydrate diet as an evil in the child community, and with the importance of blood chemistry.

A MEETING of the Victorian Branch of the British Medical Association was held at Mooroopna Hospital, Mooroopna, on May 29, 1937, Dr. J. P. MAJOR, Vice-President, in the chair.

Diverticulosis and Diverticulitis.

Dr. J. A. KENNEDY read a paper entitled "Acquired Diverticula of the Large Bowel" (see page 260).

Dr. ERIC L. COOPER, in opening the discussion, said that as the subject had been so fully covered, he proposed to confine his remarks to the details of the medical treatment of diverticulitis and to the difficulties in the diagnosis from carcinoma of the sigmoid colon.

The most common clinical picture of diverticulosis with diverticulitis of the colon was that of a middle-aged to elderly man complaining of discomfort in the left iliac fossa. The patient looked well, was often overweight for his height and age, and might have attacks of pain or irregularity of bowel action. These patients were often looked upon as the male counterpart of the more common "abdominal woman", for their symptoms were out of proportion to the physical signs detected.

Occasionally blood and mucus might be found in the faeces, and the shape of the stools might be abnormal.

Carcinoma of the colon was rare in patients suffering from diverticulitis, but Dr. Cooper had seen the combined lesions in at least three patients. Therefore the difficulty in diagnosis was not merely the separation of the two diseases, but rather the definite exclusion of a carcinoma of the colon. The importance of the decision was that the one condition was peculiarly amenable to surgical removal, while the treatment of diverticulitis was entirely medical when there were no acute complications.

The differential diagnosis rested primarily on a careful clinical history. Loss of weight, extreme pallor and frequent attacks of diarrhoea suggested carcinoma; but not all carcinomata of the colon were associated with loss of weight. Dr. Cooper had actually seen a gain in weight for some months in a patient with a proven malignant condition of the colon.

Rectal examination in diverticulitis often demonstrated a fixed tender mass outside the rectum. If the tenderness was extreme, and particularly if pressure on the mass gave suprapubic discomfort or a desire to urinate, the diagnosis was probably diverticulitis rather than carcinoma.

The abdominal mass of peridiverticulitis was usually more elongated, more fixed and more tender than a palpable carcinoma of the pelvic colon; the mass in diverticulitis often varied in size on successive examinations.

Radiological examination was not always conclusive in separating carcinoma from diverticulitis. Often the radiologist, by barium meal and barium enema examination, was able to report the presence of multiple colonic diverticula associated with a fixed mass deforming the outline of the bowel. It might be necessary to reexamine the patient with barium on several occasions at some months' intervals before a diagnosis was obtained.

Sigmoidoscopic examination should be performed in every patient in whom the diagnosis was in doubt.

The sigmoidoscope should be passed without an anæsthetic, as there was a real danger of perforation of the fixed rigid bowel if the instrument was passed without the cooperation of the patient. Too great an air pressure should not be used owing to danger of rupture of a diverticulum. Diverticula were rarely visible through the sigmoidoscope, but the discovery of a fungating ulcer would settle the diagnosis of malignant disease.

Finally the diagnosis between carcinoma and diverticulitis rested on a combination of the above means of investigation; in some patients observation over a period of some months might be necessary; in others a laparotomy might be performed, but even with the bowel exposed the diagnosis between carcinoma and diverticulitis was by no means easy.

Dr. Cooper showed lantern slides illustrating the clinical findings and radiological appearances in two patients suffering from diverticulitis.

He said that the treatment of diverticulosis lay mainly in the prevention of complications by regularity of bowel action, bland diet and warning against straining at stool. The treatment of diverticulitis and its complications, in

the absence of perforation or obstruction, was entirely medical in the majority of patients.

The principle of treatment was rest to the colon. In the acute stages a low-residue diet, largely made up of soluble carbohydrates, might be necessary, but in the more chronic phases a high-residue, non-irritating diet, combined with rest in bed and relief of spasm, formed the main lines of treatment.

A minimum period of three weeks' absolute rest in bed was necessary for every patient with diverticulitis; thereafter rest in bed for at least three hours during the day was required. The patient, in the later stages of treatment, should not rise before twelve midday or, if he got up during the morning, he should return to bed for at least three hours in the middle of the day. This restriction should be continued for at least two months. It was amazing to find a large painful abdominal mass gradually subside and disappear with practically no other treatment than rest in bed.

Rest to the colon implied a bland diet with sufficient residue to distend the colon—to prevent constipation and to open the orifices of those diverticula which were not already closed by an inflammatory stricture. It was not necessary that a diet which left a bulky residue should contain much roughage. Wholesome bread, skins and seeds of fruit and raw fruit should be avoided. Spices, pickles, sauces and condiments irritated the colon and should be omitted.

Dr. Cooper set out the following bland diet, leaving a high residue, as suitable.

On Rising: Water or barley water or fruit juice.

Breakfast: Strained gruel with milk; one egg or tender meat or fish; two slices of stale white bread or crisp toast; butter; jam without seeds or skins, or honey or jelly; weak tea or coffee with milk.

Luncheon or Tea: Boiled or underdone roast meat or fish or eggs; plain sweet, as rice pudding, boiled rice, ice cream, junket or jelly; stale white bread or toast; cream, butter; strained jam or honey or golden syrup; "Marmite" or "Vegemite"; weak tea with milk.

Dinner: Clear broth or strained vegetable soup; tender meat or fish; mashed potato; mashed vegetables (soft cooked), as tender carrots, French beans, spinach; plain milk pudding or jellied mould; orange juice or soft-cooked fruits without skins or seeds, as tinned or cooked peaches, apricots, strained apple, baked apple without skin; weak tea with milk and sugar; cream.

Morning Tea, Afternoon Tea and Supper: Weak tea with milk and sugar; plain biscuit; sponge cake (no fruit or nuts); stale bread and butter with "Marmite"; fruit juice. If the patient was constipated, one tablespoonful of agar-agar should be taken at each meal. Brewer's yeast also to be taken at meals.

The articles of diet that were proscribed included: nuts, condiments, pickles, sauces, salt foods, seasoned foods, fried food, suet puddings, dried fruits, tough meat, coarse fibred vegetables, raw fruits unless soft, skins or pips of fruit, pastry, rich cakes, roast potatoes.

This diet should contain at least 2,500 calories, with adequate vitamins and mineral residue. Such diets had been in use for some years with good results both in hospital and in private practice.

When the patient was on this diet it was necessary to pay particular attention to his teeth. The lack of roughage might result in an ulcerative condition of the mouth and gums, sometimes associated with parotitis. The teeth should be scaled, any cavities filled and carious teeth removed. An X ray examination should be made of the remaining teeth to discover pockets or apical sepsis.

The bowels were best lubricated by oily substances; irritant purgatives were forbidden unless the patient could not get an easy bowel action without them; in such cases senna was of most value. Paraffin oil or paraffin with agar-agar was most often prescribed, but Dr. Cooper preferred to use olive oil. Some patients on paraffin oil passed small scybalous masses without emptying the colon; in others the paraffin leaked past the anal sphincter; in a

few patients paraffin seemed to set up irritation in the colon. For these reasons olive oil in doses of one-half to one ounce twice daily were prescribed for patients with diverticulosis.

A regular habit of going to stool at fixed times during the day was of as great importance in the treatment of diverticulitis as it was in the prevention of complications in simple diverticulosis.

Many patients were assisted by enemata of warm normal saline solution, which emptied the lower bowel. Bowel wash-outs should never be given; the possible benefits of internal heat and lavage were more than offset by the danger of irritation of an inflamed colon and by the risk of perforation of a thin-walled diverticulum.

When a saline enema was administered, the douche can should not be elevated more than eighteen inches above the level of the anus. The quantity of normal saline solution injected would vary with individual patients; if the solution was run in slowly, most patients would tolerate at least a pint if there were no acutely inflamed diverticula around the bowel.

On the contrary, a few patients were upset by saline enemata, and rectal injections of olive oil often gave great relief to them. The oil was run in by a catheter or syringe; the patient was instructed to lie quietly on his left side for as long as possible; no food was given while the oil was in the bowel. If the oil was given at night, many patients could retain six or ten ounces of olive oil for as long as eight to ten hours.

Local heat applied to the abdomen sometimes gave relief to those patients in whom there was constant pain. An electric cradle or the electric radiator suspended above the bare abdomen for half an hour two or three times a day often helped a great deal. Moist heat or other forms of heat requiring the application of weight or pressure on the abdomen were distressing to the patient with diverticulitis.

Painful spasm of the colon or an excessively active gastro-colic reflex might be relieved by full doses of belladonna in the form of the tincture. A start being made with five minims three times a day before meals, the dose should be gradually increased until the patient complained of dryness of the mouth or difficulty with vision.

Violent physical exercise and massage to the abdomen were forbidden in patients with diverticulosis because of the danger of rupture of a thin-walled or inflamed diverticulum.

Probably only one patient out of every four with diverticulosis developed symptoms of diverticulitis; by careful attention to the details of medical treatment the majority of patients with diverticulitis remained comfortable—the inflammatory changes subsided and the risk of intestinal obstruction and perforation was greatly reduced. The essentials of treatment might be summed up as: (i) rest in bed, (ii) bland high-residue diet, (iii) olive oil by mouth, (iv) saline solution enemata or olive oil *per rectum*, (v) belladonna, (vi) dry heat applied to the abdomen.

DR. VICTOR HURLEY said that the surgery of diverticulitis was practically confined to the sigmoid and the pelvic colon, and also was indicated only when serious infective or obstructive complications occurred. Regarding its incidence, W. J. Mayo, in analysing the cases met with during several years at the Mayo Clinic, had found that in 1,918 cases the relative proportion of males to females was as 64 to 36. He also found that the condition occurred as frequently in thin as in fat people. During one period when 1,259 cases of carcinoma of the colon were met with, there were 653 cases of diverticulitis of the colon. Mayo further thought that probably 5% of all patients over forty had diverticulosis, although only a proportion of these developed diverticulitis. The complications of infection and obstruction might be met with in varying degrees, either singly or combined, and the obstruction might be due either to the swelling and infiltration associated with infection, which was really a cellulitis, or to hyperplasia with adhesions, angulation and perhaps actual stenosis. It was very difficult even at operation to assess the relative importance of these factors of temporary swelling due to

acute inflammation, and the fibrosis and scarring of recurring or chronic inflammation. It was also usually noted that often when the obstructed narrowed area had been removed and opened up there was surprisingly little obliteration of the lumen. The diagnosis between diverticulitis and carcinoma of a mass in the sigmoid exposed at operation was very difficult even in experienced hands.

Regarding the patients requiring surgical treatment, Dr. Hurley said that it might be convenient to divide the cases into groups and to instance some illustrative cases.

The first group was characterized by acute onset with perforation or abscess formation and subsequent peritonitis in the left side of the lower part of the abdomen. The diagnosis of such cases was usually readily made, and the clinical symptoms and signs were much the same as those of spreading peritonitis associated with acute appendiceal infections in the right iliac fossa. The peritonitis associated with perforative diverticulitis was, however, particularly violent and deadly, more so than that arising in the right iliac fossa. In some of the cases the history showed evidence of abscess formation during the first few days, with later perforation and peritonitis.

Dr. Hurley's first case was that of a stout elderly female of sixty-eight years, who had vague abdominal pains for about fifteen years. Six weeks before she was first seen in consultation an X ray examination had shown a well-marked diverticulosis of the whole colon, but especially of the sigmoid. During the last few days the pains in the left iliac fossa had been more severe, with vomiting, and three days before her admission to hospital the pains had become very acute. On examination she presented evidence of pelvic peritonitis and was very ill. At operation there was much pus in the lower part of the abdomen and pelvis, and an abscess between the sigmoid and the abdominal wall. There was a large indurated mass in the sigmoid. Drainage was provided and a colostomy was also carried out. Some improvement resulted during the first few days, but the evidence of infection continued and the patient gradually sank and died a month later.

Dr. Hurley's second group was one characterized by spreading cellulitis (peridiverticulitis) of the tissues of the left iliac fossa and the retroperitoneal tissues. In these cases no actual abscess developed, although this was exceedingly difficult to ascertain before operation.

Dr. Hurley's second case was that of a male, aged sixty-three years, who had complained for three to four weeks of lower abdominal pains and constipation with some distension. His bowels had acted, but there was a feeling of incomplete emptying. He had been in hospital in the country for a month, running a temperature between 37.8° and 38.2° C. (100° and 101° F.), with tenderness and rigidity over a sausage-shaped swelling in the left iliac fossa. This continued for the next week, while he was under observation, and then an X ray examination was carried out after an opaque enema had been given. This revealed diverticulosis of the colon, especially of the sigmoid. On rectal examination there was also a tender thickening or mass palpable. At operation a thick-walled oedematous sigmoid with many diverticulae was seen and there was a condition of cellulitis in the left iliac fossa, which extended down into the pelvis as a cylindrical swelling, and also upwards. A glove drain was placed in the cellular tissues and the abdomen was closed. The temperature and evidence of infection persisted after operation and very slowly subsided during the next few weeks. Blood culture was without result. Three months later the patient's doctor reported that he eventually made a good recovery and had returned to work.

Dr. Hurley's third group was characterized by low grade infection with or without obstructive symptoms. Most cases met with were of this type and, if the patients were treated medically as had been outlined by the previous speakers, the symptoms would usually subside.

In these cases there was abdominal pain in the left iliac fossa, with the development of a lump or mass in relation with the sigmoid. The temperature was slightly elevated, perhaps to 37.8° C. (100° F.); the patient did not look ill or toxic; there might also be irregular colicky

pains with "wind". The pain and evidence of infection often cleared up after two or three days' rest, though the tender swelling might be present in diminishing degree for some weeks. The diagnosis of these cases from carcinoma was often very difficult, and even if the X ray films showed the presence of diverticula, this did not necessarily settle the matter, as the two conditions might be associated; or, as W. J. Mayo emphasized, carcinoma not infrequently supervened on long-standing or recurring diverticulitis.

Dr. Hurley's third case was that of a female, aged sixty-two years, of spare build, who had suffered two weeks previously from smart colicky pains all over the abdomen, with tenderness in the left iliac fossa. There had been a mild elevation of temperature for twenty-four to thirty-six hours. The patient rested and felt better again until two days previously, when the pains recurred more severely, with a temperature of 37.8° C. (100° F.), and there was a rather firm, well-localized, tender lump in the left iliac fossa in connexion with the sigmoid. The pain subsided in two days, but the lump was palpable for a week. X ray films after an opaque enema was given revealed gross diverticulosis of the colon with delay at a stenosed area in the distal pelvic colon. This was well within the range of a sigmoidoscope, and at sigmoidoscopic examination a few days later, on gentle inflation of the bowel pain was produced in the left iliac fossa and no carcinoma could be seen. Usually the orifices of the diverticula could not be seen, but in this case a small opening in the mucosa was seen, which it was thought represented the opening of a diverticulum. Under the usual medical régime the patient had since been quite comfortable.

Dr. Hurley's fourth case was that of a man, aged sixty-three years, with a similar history and findings to those in Case III. X ray films showed diverticula in the descending colon and sigmoid, with inflammatory induration around these. The patient was in hospital for two weeks, and when seen a year later had had no further recurrence.

Dr. Hurley's fifth case was that of a woman, aged fifty-five years, who had noted acute pain in the left iliac fossa twenty-four hours before being seen in consultation. The pain had persisted and the temperature was 37.9° C. (100.2° F.). There was tenderness and rigidity over a lump the size of a golf ball in the left iliac fossa. There had been a previous similar attack six weeks previously. In this patient there seemed a possibility of a left-sided appendicitis. Operation was performed. The lump was found to be in the sigmoid and was readily delivered through the incision. As the process was well localized and as carcinoma could not be positively excluded, resection was decided on and six inches of sigmoid, including the lump, were removed and end-to-end anastomosis with caecostomy was carried out. Other diverticula in the neighbourhood were seen. On opening the removed bowel afterwards, a diverticulum containing a stercolith was found between the layers of the mesosigmoid. The patient made a good recovery and had since been free of abdominal symptoms, though X ray examination still showed the presence of large numbers of diverticula throughout the colon.

Dr. Hurley's fifth group included cases with evidence of definite obstruction. He related the history of a very stout woman of sixty years, who had been admitted to hospital with a history of threatened intestinal obstruction of four days' standing. Aperients and enemata had been unsuccessful. Frequent vomiting had occurred on the day before the patient's admission to hospital. Her temperature was 37.8° C. (100° F.) and there was tenderness in the left side of the lower part of the abdomen. The abdomen was much distended, but enemata in hospital produced some action of the bowels, and her condition improved. X ray examination revealed what was regarded as practically a complete obstruction of the pelvic colon at the level of the pelvic brim, the appearances being regarded as those of extrinsic pressure or an inflammatory condition surrounding the bowel. One diverticulum was also seen. Sigmoidoscopic examination without an anes-

thetic revealed no abnormality up to twenty centimetres from the anus. As the distension subsided, a large mass could be felt just below the pelvic brim. Operation was carried out a week after the patient's admission to hospital, and the mass was found in the sigmoid with extensive adhesions to the adjacent bowel and infiltration of the mesosigmoid. It was, despite the X ray report, regarded as being probably malignant, and resection was decided on. This proved very difficult; eight to ten inches of bowel were removed, and continuity was restored by end-to-end anastomosis by Balfour's method, with the aid of a tube inserted by the rectum. During the removal of the indurated mass some anxiety was felt regarding the left ureter, and this was evidently damaged because a faecal and a urinary fistula occurred. Left nephrectomy was carried out two months later and the patient left hospital in another month with a small intermittent faecal fistula, which usually drained about half an ounce a day until her sudden death three years later from a cardiac attack.

Dr. Hurley said that this case illustrated the difficulties and dangers of attempting resection in cases in which such an operation should be attempted only if a small area was involved. It was occasionally justified by the result, as in the fifth case, especially as the other operative procedures at disposal (*colostomy et cetera*) gave such poor and unsatisfactory results. With further experience of these cases, when a large portion of the bowel wall was indurated or firmly fixed (and these were the majority), Dr. Hurley would now drain any local collection of pus and perform a transverse colostomy, dividing the bowel completely and diverting the stream of intestinal contents, on the principles advised by Devine for "defunctioning" the colon. It was then advisable to maintain such a colostomy for many months, perhaps a year or longer, before making any attempt at a later resection of the area involved by the diverticulitis, if X ray and other evidence showed this to be required because of the obstructed bowel lumen. In some cases, however, even after prolonged drainage by colostomy, it might be found impossible or inadvisable to resect the involved area, and in these the colostomy would be permanent. Colostomy as usually carried out, without complete diversion of the intestinal stream in the vicinity of the growth, was of little or no use, and caecostomy, while affording some temporary relief, was unsatisfactory. It could not always be assumed that if a patient remained alive and well for some years after a colostomy for an irremovable adherent mass in connexion with the sigmoid or pelvic colon, that the mass was therefore inflammatory and not malignant. A case was quoted in which such a patient was seen three years after colostomy for a supposed irremovable sigmoid carcinoma and in whom sigmoidoscopic examination and biopsy then confirmed the diagnosis of carcinoma, which was at that time apparently operable. The patient, however, refused further operation and died three years later—six years after the original colostomy.

X ray films and clinical notes of several patients with diverticulosis and diverticulitis were also discussed.

Dr. JOHN O'SULLIVAN discussed the subject from the radiological aspect and showed a number of films illustrating diverticulosis. One series dealt with a case of diverticulosis of the descending and sigmoid colon, associated with carcinomatous strictures of the ascending and transverse colon, one situated proximal to the hepatic flexure and the other in the mid-transverse colon. The importance of the technique employed in the air insufflation method was stressed, special emphasis being laid on the necessity for careful insufflation of air into the bowel and the danger of rupture of the bowel through too vigorous insufflation. Dr. O'Sullivan drew attention to the importance of the diagnosis of the prediverticular condition. Mucous membrane relief studies showed the commencing herniation of the mucous membrane through the muscle. Dr. O'Sullivan said that he believed the so-called spastic colon to be the precursor of diverticulosis, and he stressed the importance of treating the spastic condition of the large bowel; this was due to some disturbance of the normal muscular mechanism of the large intestine.

He was of the opinion that this irritable spastic condition of the large bowel should be treated to prevent the formation of diverticula.

Dr. A. E. DICKMAN then showed for diagnosis a patient who had a movable lower abdominal tumour. It was generally agreed that the condition was not diverticulitis, and a number of opinions were expressed. It seemed probable that the tumour was associated with the bladder.

Dr. HENRY MORTENSON said that the symptom of frequency of micturition had from one surgical out-patient clinic on three occasions in two years made the condition of diverticulitis of interest to him as a urologist. Fixation to the bladder as well as simple pressure would give rise to irritation of the bladder. In one out of the three patients there had been evidence of oedema of the base of the bladder. Urologists encountered the third stage of colo-vesical fistula, of which condition diverticulitis was the most common underlying factor.

Dr. W. A. HAILLES, with reference to operations for diverticulitis with obstructive symptoms, said that not only was he not able to see the opening in the affected diverticulum, but as a rule he did not even know which diverticulum was responsible for the trouble. He was pleased to hear Dr. Hurley mention the word "cellulitis" in this condition; Dr. Hailles himself also was in the habit of speaking of "cellulitis", and had seen the descending colon involved as far up as the splenic flexure. He looked upon it as an inflammatory condition which caused temporary obstruction; the lumen of the bowel might become patent again; it was very difficult to perform colostomy at the time of the original operation. When a ward sister at the Melbourne Hospital stated that, in giving an enema to a patient, she was not able to run in more than two or three ounces, Dr. Hailles regarded it as valuable evidence of the presence of cellulitis. It was reasonable to expect that the condition would subside or that a local abscess would be formed. Dr. Hailles also stated that he had operated and found an abscess in the colon wall. He had become conservative, and if it could be avoided he would not carry out resection. He had performed transverse colostomy, and later a patent colon had been demonstrated by Dr. Hewlett, but dozens of diverticula could be demonstrated in the films. On considering the matter he was able to state that it had occurred to him that he had never had to operate a second time on one of these patients: the inflammatory condition was not recurrent. In conclusion, Dr. Hailles said that he thought that radical treatment by resection and anastomosis was foredoomed to failure, because it required small bowel to stay in a part of the abdomen in which it was not in the habit of living.

Dr. S. O. COWEN said that the condition was one of which he had had personal experience at the hands of Dr. Hailles and Dr. Turnbull. In Dr. Kennedy's excellent and complete paper Dr. Cowen had noticed that one point had been overlooked. Occasionally, in the case of a patient with diverticulosis or diverticulitis, a single brisk symptomless hæmorrhage might be the only sign. Dr. Cowen thought that some of the obstructive symptoms were due to a peculiar form of ileus, and he believed that there was an element of localized inflammation of one or more diverticula. The obstruction was overcome so quickly at times that he felt it must be largely functional. He could not condemn too strongly the practice of using purgatives, which prolonged the condition and made it more severe, liquid faeces and flatus being driven into the inflamed colon. With reference to treatment, Dr. Cowen said that absolute starvation was advisable for twenty-four hours. He gave absolutely nothing but free fluids, such as water and glucose, tea and barley water or strained broth. He believed in the use of repeated enemata. Bowel wash-outs were useless and very distressing to the patient; it was a mechanical impossibility to wash out hard faeces through a tube; it was not only useless, but mischievous. Half to one pint of plain water, without saline or soap, should be run in, and the colon should be allowed to empty itself; this should be done three or four times at short intervals. Referring to medical treatment

between attacks, Dr. Cowen expressed entire agreement with Dr. Cooper's general ideas, though he thought that the ulcer diet was very trying. He had no objection to the use of abundant stewed apples and other softer stewed fruit. He did not like giving plain mineral oil, on account of its tastelessness and its inefficacy; in emulsions it was pleasanter, more effective, and less apt to leak; he had found "Cream of Nujol" satisfactory. He would like to utter a warning against the use of any emulsion containing phenolphthalein, as this substance was reabsorbed and reexcreted; it did not know when to leave off, but nagged without giving satisfaction. "Normacol", which was rather expensive, or "Isogel" granules were more effective than mineral oil emulsion, because they were more stimulating. Agar-agar would do, but it was difficult to administer. In conclusion, Dr. Cowen said that many of these patients were often constipated as well as obese, and needed something to assist defecation while taking a bland diet. He considered that the best drug for them by far was senna. Syrup of senna in a small dose two or three times daily acted very well; "Lixen" was a satisfactory preparation of senna. Treatment of the condition under discussion should be largely at the hands of physicians, except for the rare complications of infection and obstruction.

Dr. R. F. O'SULLIVAN said that those who used spinal anaesthetics had a wonderful opportunity of finding pre-diverticular conditions and actual diverticula; he had seen faecoliths in diverticula packed so tightly that the covering was very thin. In the worst case he could remember, multiple faecoliths had been present with a mere serous covering. The abdomen had been closed and the patient warned, but no trouble had followed, nor had any arisen over a period of years while the patient was under his observation.

Dr. E. V. HUGHES-JONES said that when dealing with faecal and urinary fistulae it was very difficult to decide on the best surgical treatment. Endurance of colostomy by a patient even for as long as two years was not enough to clear up the fistula. A large series of patients had been followed up, and he had studied a number of records. He recalled that a colostomy had had to be reopened because suppuration recurred or vesico-colic fistula had formed. Once a colostomy had been performed the patient's life was reasonably safe while the colostomy was open, but he was in great trouble once the colon was closed. One authority advocated that nothing of the sort should be done for vesico-colic fistula; tolerance of the state of affairs would be established, and there was no need to worry about the risk of ascending infection of the ureters and kidneys.

Dr. A. E. COATES expressed gratification, on behalf of the Science Subcommittee of the Branch Council, at the success attendant upon the new departure of limiting the evening meeting to one paper followed by a discussion. He then referred to one or two rare experiences that he had had with complications of diverticulosis. An acute small bowel obstruction occurred and the obstructed area was bound down by adhesions after fifteen years of diverticulitis; The left side accommodated the greatest length of small bowel. On another occasion he had opened into the ampulla of the uterine tube, and by this means had detected the diverticulum involved; he had never been able to oversee one otherwise.

Dr. J. P. MAJOR, from the chair, thanked the speakers and congratulated the members on the excellence of the discussion.

VICTORIAN BRANCH NEWS.

The following items of news, of particular interest to members of the Victorian Branch of the British Medical Association, are published at the request of the Council of the Branch.

Repatriation Local Medical Officers.

The Repatriation Department complains that some of its local medical officers are failing to carry out the duties

for which they were appointed, particularly in regard to the keeping of accurate records of all attendances and the furnishing of reports. In addition to the inconvenience caused to the officials of the department, the absence of records is in many cases prejudicial to the interests of returned soldiers who apply for an increase of pension. Unless certain medical officers mend their ways, it is more than probable that some of the appointments will be terminated.

Workers' Compensation.

Members are advised to bring to the notice of their patients the following extract from the second schedule to the *Workers' Compensation Act*:

In computing or otherwise determining the amount of compensation payable under this Act whether the claim for compensation was made before or after the commencement of the *Workers' Compensation Act 1922* regard shall not be had to any sum paid or payable, whether before or after the commencement of the said Act, under any contract of assurance or insurance (including a contract made with any friendly or other benefit society or association or any trade union) or out of any relief or sustentation fund or other fund (whether statutory or otherwise) of the like nature.

On several occasions recently it has been reported that an official of an insurance company has telephoned doctors suggesting that they reduce their fees for visits to patients coming under the provisions of the *Workers' Compensation Acts*. Members are requested to reject any such proposal.

NOMINATIONS AND ELECTIONS.

The undermentioned has applied for election as a member of the Western Australian Branch of the British Medical Association:

Piccles, Jack Walter, M.B., 1928 (Univ. Sydney), Carnarvon.

The undermentioned have been elected members of the Victorian Branch of the British Medical Association:

Agar, John MacDonald, M.B., B.S., 1936 (Univ. Melbourne), Alfred Hospital, Prahran, S.I.

Clarke, Percy Gowan, L.R.C.P. et R.C.S., 1898 (Edinburgh), L.F.P.S., 1898 (Glasgow), Flisken Street, Ballan.

Gardner, John Kelvin, M.B., B.S., 1936 (Univ. Melbourne), Royal Melbourne Hospital, Lonsdale Street, Melbourne, C.I.

Dunn, Douglas John MacLeod, M.B., B.S., 1935 (Univ. Melbourne), Alfred Hospital, Prahran, S.I.

Congress Notes.

AUSTRALASIAN MEDICAL CONGRESS (BRITISH MEDICAL ASSOCIATION).

The Joint Honorary Secretaries of the Fifth Session of the Australasian Medical Congress (British Medical Association) advise that the Secretary to the South Australian Railway Commissioner has informed them that members wishing to book accommodation in the Pullman car for their return journey should make the necessary application when effecting their forward booking to Adelaide. This is advisable on account of the limited accommodation in the Pullman car.

Books Received.

- MANUAL OF PRACTICAL ANATOMY, by J. E. Fraser, D.Sc., F.R.C.S., and R. H. Robbins, M.A., M.D.; Volume II: Thorax, Head and Neck, Central Nervous System, Eye and Ear; 1937. London: Baillière, Tindall and Cox. Large crown 8vo, pp. 465, with illustrations. Price: 10s. 6d. net.
- GENERAL PRACTICE SERIES. COMMON SKIN DISEASES, by A. C. Roxburgh, M.A., M.D., B.Ch., F.R.C.P.; Fourth Edition; 1937. London: H. K. Lewis and Company Limited. Demy 8vo, pp. 432, with 8 plates in colour and 165 illustrations in the text. Price: 15s. net.
- CLINICAL CONTRACEPTION, by G. M. Cox, M.B., B.S., with an introduction by Lord Horder of Ashford, K.C.V.O., M.D., F.R.C.P.; Second Edition; 1937. London: William Heinemann (Medical Books) Limited. Demy 8vo, pp. 296, with illustrations. Price: 5s. net.

Diary for the Month.

- AUG. 17.—Tasmanian Branch, B.M.A.: Council.
 AUG. 17.—New South Wales Branch, B.M.A.: Ethics Committee.
 AUG. 18.—Western Australian Branch, B.M.A.: Branch.
 AUG. 19.—New South Wales Branch, B.M.A.: Clinical meeting.
 AUG. 22.—Australasian Medical Congress (B.M.A.): Fifth Session opens at Adelaide.
 AUG. 25.—Victorian Branch, B.M.A.: Council.
 AUG. 26.—South Australian Branch, B.M.A.: Branch.
 AUG. 27.—Queensland Branch, B.M.A.: Council.
 SEPT. 1.—Western Australian Branch, B.M.A.: Council.
 SEPT. 1.—Victorian Branch, B.M.A.: Branch.
 SEPT. 2.—South Australian Branch, B.M.A.: Council.
 SEPT. 3.—Queensland Branch, B.M.A.: Branch (Jackson Lecture).
 SEPT. 7.—New South Wales Branch, B.M.A.: Organization and Science Committee.
 SEPT. 10.—Queensland Branch, B.M.A.: Council.
 SEPT. 14.—New South Wales Branch, B.M.A.: Executive and Finance Committee.

Medical Appointments.

Dr. J. L. Scholes has been appointed Public Vaccinator at Ballarat East, Victoria.

Dr. J. A. O'Brien has been appointed a Certifying Medical Practitioner and Medical Referee at Melbourne, Victoria, in accordance with the provisions of the *Workers' Compensation Acts*.

The following appointments have been made at the Adelaide Hospital, Adelaide, South Australia: Physicians, Dr. W. Ray, Dr. A. R. Southwood; Surgeons, Dr. L. C. E. Lindon, Dr. I. B. Jose; Assistant Surgeons, Dr. G. H. Burnell, Dr. W. J. W. Close, Dr. A. F. Hobbs; Bacteriologist in Charge of Vaccine and Asthma Clinic, Dr. D. L. Barlow; Curator to Ear, Nose and Throat Section of the Pathological Museum, Dr. R. M. Glynn; Curator to Ophthalmological Section of the Pathological Museum, Dr. A. L. Tostevin; Anaesthetists, Dr. R. N. Reilly, Dr. G. Brown, Dr. J. M. M. Gunnson; Ophthalmologist, Dr. J. B. Lewis; Resident Medical Officers, Dr. P. S. Richardson, Dr. W. G. Birks.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser", pages xviii to xx.

DEPARTMENT OF PUBLIC HEALTH, PERTH, WESTERN AUSTRALIA: Resident Medical Officer.
 SAINT MARGARET'S HOSPITAL FOR WOMEN, SYDNEY, NEW SOUTH WALES: House Surgeon, Honorary Officers.
 WESTERN AUSTRALIAN PUBLIC SERVICE: Assistant Medical Officer.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phoenix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. House, 235, Wickham Terrace, Brisbane, B.17.	Brisbane Associate Friendly Societies' Medical Institute. Proserpine District Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY Hospital are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 173, North Terrace, Adelaide.	All Lodge appointments in South Australia. All contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.

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